DESIGN FORECAST

DESIGN FORECAST 1

Cover photograph *by Emma Landau symbolizes* DESIGN FORECAST'S *desire to invite and guide its readers into this first issue. Before becoming our cover, the symbol served long to beckon potential customers into a shoe shine parlor on New York's East Side.*

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DESIGN FORECAST 1

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FRONTISPIECE: DESIGN FORECAST *is an open door for designers and businessmen, to explore new ideas in the design field and to learn of the "designer's metal" —aluminum. The particular open door: mock-up, using a typical aluminum door in the Alcoa Building, employing an experimental gold-anodized patterned aluminum sheet. Familiarly called the "cup-cake," the pattern is produced on dies developed as part of an Alcoa experimental program.*

ALCOA and DESIGN

To The Reader:

You are about to take a look at DESIGN FORECAST, a new Alcoa publication. This book is intended for designers and design-minded business executives. It is essentially a pilot project. The why's and wherefore's of DESIGN FORECAST are outlined by Alcoa's Chief Industrial Designer Sam Fahnestock on the opposite page. I would like to set the stage for you by briefly outlining why Alcoa is vitally concerned with the design field.

Aluminum's history has been one of displacement of other materials. This displacement began when cast aluminum teakettles were made from the same molds as cast iron teakettles, in the 1890's. It continues today, with aluminum conductor replacing copper for such new uses as coil windings, with the aluminum engine block about to become a reality in competition with cast iron, and with anodized aluminum being chosen over chrome-plated steel for appliances and automobiles.

Alcoa has long known that the success of aluminum in increasing its markets would be directly related to Alcoa's success in enhancing the natural advantages of aluminum. This has motivated a half century of research and development activities, which have yielded major gains for aluminum, in the form of new alloys, fabricating techniques, joining practices, finishes, and a deep technical knowledge of our product.

We constantly see increasing evidence of the vital influence exerted on the choice of materials for America's products by the industrial designer. Alcoa engineers have worked with industrial designers for many years, but, I am sure you will agree, the designer's most profound impact on industry has been in the last decade.

As we became aware of the dynamic importance of the industrial designer, our conclusion was inescapable. Since we are producers of a material that must be chosen and specified, we must be in contact with those who are doing the choosing and specifying. Possessing a wealth of information about our metal, we must see that it is available to those who can use this knowledge.

Our programs with industrial designers, begun over the past five years, aim to place Alcoa's knowledge and facilities at the disposal of any designer who can use them. Our own industrial design group was established for the sole purpose of aiding industrial designers in their projects—not in any way to compete with the designer!

We feel that DESIGN FORECAST fits into this framework. We hope you will conclude that this book charts a new course in publications for designers. In addition, we trust that DESIGN FORECAST will challenge the broad interests of its readers.

DESIGN FORECAST will be a success if it is of value and interest to you. It is our hope that you will find it so.

FRANK L. MAGEE
President

WHY "DESIGN FORECAST"?

To The Reader:

While we were requesting contributions from the authors of the signed articles in this Issue 1, we had to try to define DESIGN FORECAST without benefit of a tangible example. We said then that this book is, "by and about designers, and about design in general and aluminum in particular." As it took form, we saw that the book was approximately as we originally described it, and that we had apparently attained our two primary goals in publishing the book.

The first of our objectives is to provide information to the designer about aluminum. If I were quintuplets, this goal would be of no concern. As Mr. Magee says, Alcoa's design group exists as an aid to designers. Our problem is that the assistance and advice we should be providing far exceeds that which we actually can provide with the time and staff available.

And so, DESIGN FORECAST. Pretty close to half of the book will represent pragmatic, "nuts and bolts" information about Alcoa's favorite subject. Over a period of time, it will represent what our design group would present to you in person, if we were physically capable of visiting the thousands of offices into which DESIGN FORECAST is going.

Though we can casually characterize this information as being technical, I think that you will find it imaginatively inspiring. We are truly excited about this fascinating metal of ours. And I don't think we flatter ourselves when we say we have good reason to be excited. Our enthusiasm is based on an awareness of aluminum's capabilities and its peculiar qualifications as a designer's material. We hope to communicate this awareness—and the enthusiasm—to the readers of DESIGN FORECAST.

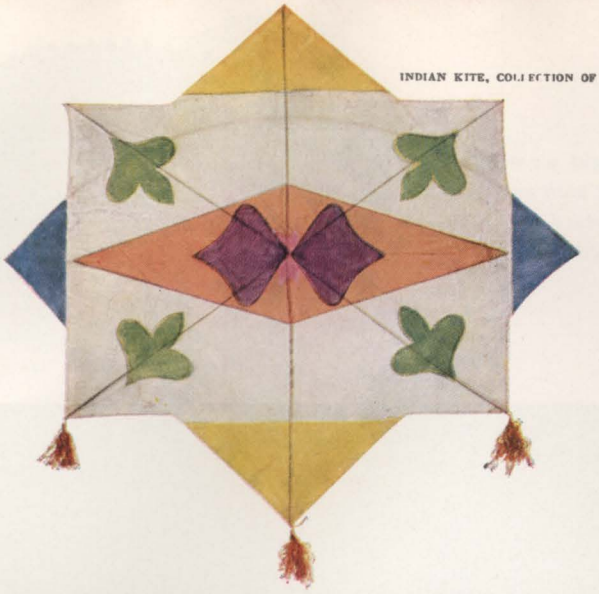
And the second reason? A little harder to define, but perhaps best labeled "public relations." Not, however, by any means, is its goal solely a matter of Alcoa's public relations with the reader of DESIGN FORECAST.

What we do hope is that this publication will assist in defining and clarifying the designer's relationship with his corporate clients, and the corporation's relationship with its design counsel. We see this as a job to be done by the designer and by the corporate executive; they will speak to each other through the pages of DESIGN FORECAST.

We are very selfish when we ask that you tell us what you think of DESIGN FORECAST. We want this to be a provocative, informative tool for its readers. Your suggestions will enable us to make it so. (And, the comments on what is said in Issue 1 may well comprise Issue 2!)

I hope you enjoy your proxy visit from Alcoa's design group!

SAMUEL L. FAHNESTOCK
Chief Industrial Designer



INDIAN KITE, COLLECTION OF THE AUTHOR

INSPIRATION

ILONKA KARASZ

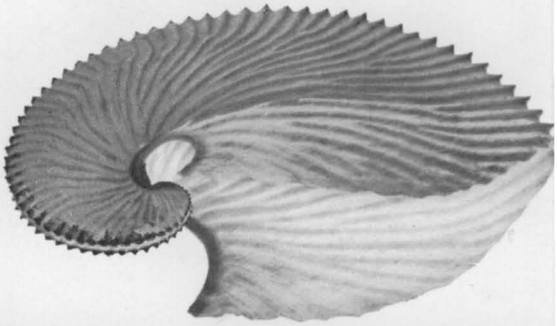
is a moment of contact with another reality, the moment when everything at once falls into its proper place; when, as it were, the entire structure appears, and every part is seen to be related to the whole. So we cannot deny it exists, nor can we remain indifferent to the experience of this momentary, magical change in our insight. Having had the taste of this other reality, (for surely it is not our everyday fare), we wait for its unpredictable reappearance. We also know that without it we are cut off from the source of our true nourishment, and everything we make is empty, is without life, belongs to no organic structure.

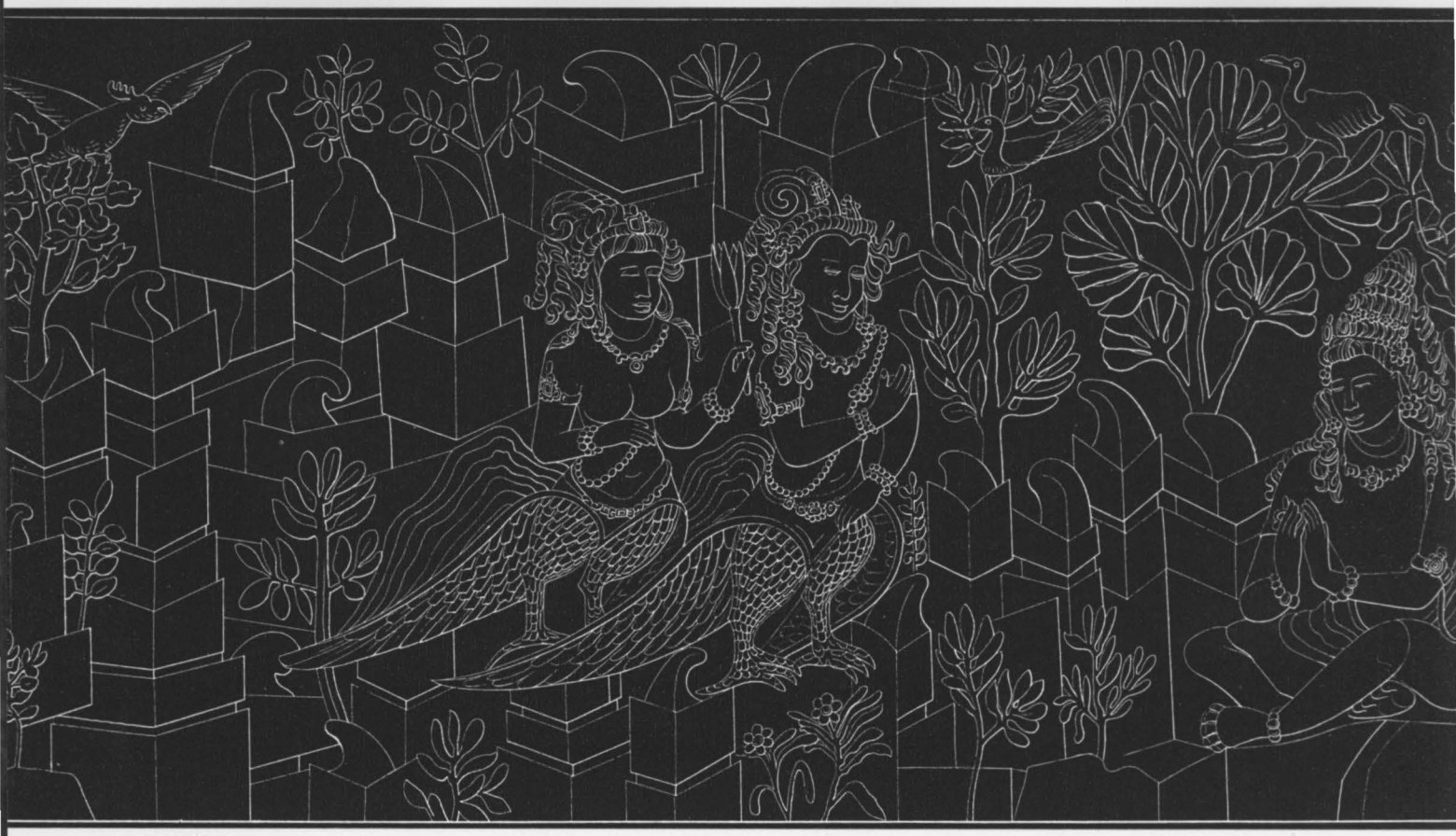
There is evidence of the workings of this reality

This example, part of the roof of a four hundred year old farmhouse in Japan, shows understanding of the manner in which nature creates; where, "each element, each material has its own existence stated clearly, always with a sense of value beyond itself— of the spiritual emanating from the material, and the universal reflected in the particular." (Carver, "Form and Space of Japanese Architecture.")

FROM "FORM AND SPACE OF JAPANESE ARCHITECTURE," NORMAN F. CARVER, JR., AUTHOR-PHOTOGRAPHER
SHOKOKUSHA PUBLISHING CO., TOKYO

In the formation of shells at the right, we see evidence of an order so exact that with awe we realize this must be true of all nature. The artist should be able to anticipate this order of nature.

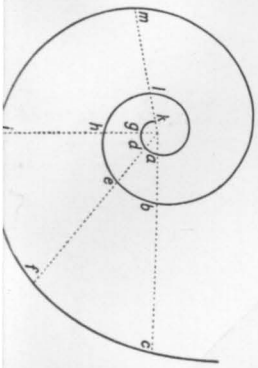


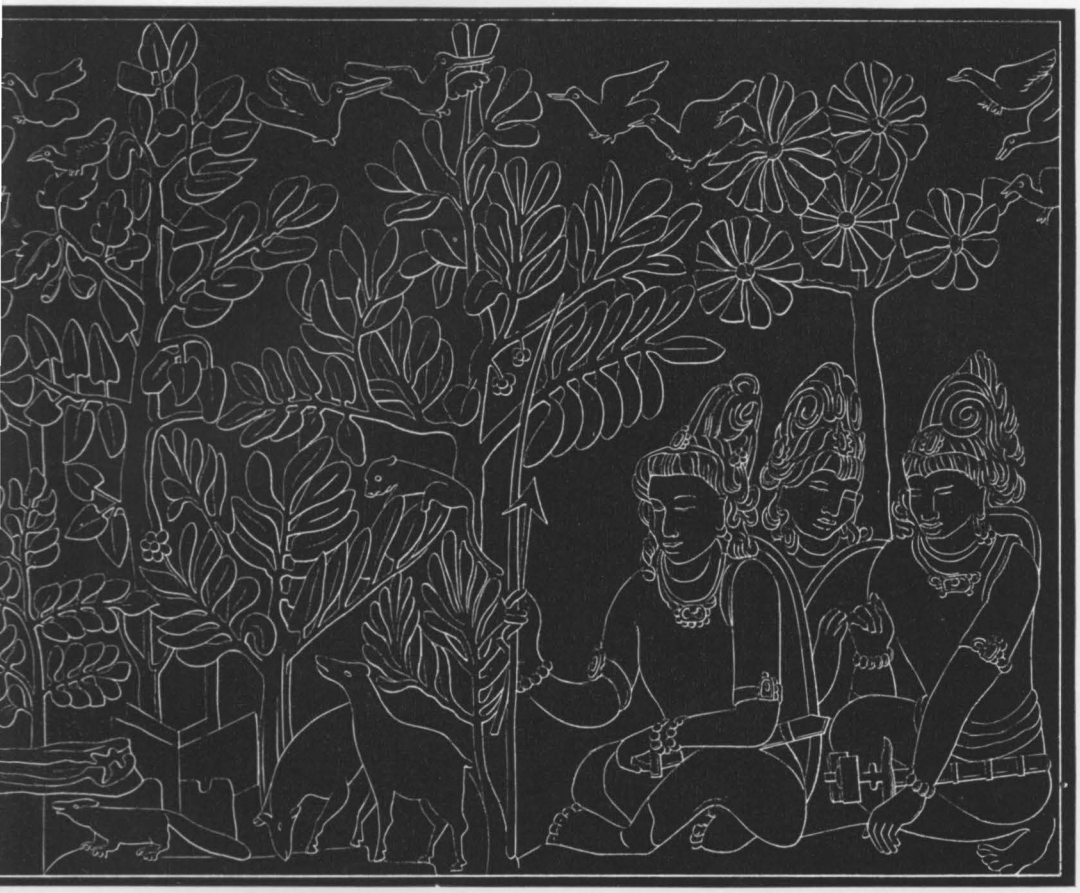


COLLECTION OF THE AUTHOR

even before history, and evidence that it has gone on all through history, but not consecutively. Mysteriously, the example appears, much the same way as the moments do in us. And then, mysteriously again, it reappears somewhere else. Yet, by their quality, the two appearances are related. Malraux says that, "True arts and cultures relate man to duration, sometimes to eternity." The neolithic man, when decorating his cave, was in the spirit of such reality; and in that we have an immediate recognition of this timeless world. The art of Asia, ancient or today, very definitely speaks of the existence of an "order," known and expressed. "Asiatic art," Ananda Coomaraswamy says, "is ideal in the mathematical sense; like nature, not in appearance but in operation."

The artist finds what he is looking for only in himself; but, having found it, he corroborates his discovery by looking to those examples of the creative moment that history has spared to us, and also to those statements of truth which express "nature, not in appearance but in operation"—to the mathematical principles on which nature builds and which are the basis of all creation.

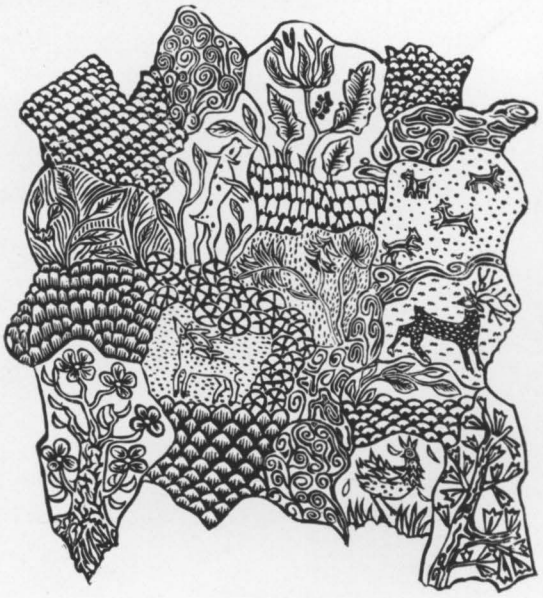




A lithographic outline of a small section of carvings from the temple of Borobudur. They bring to mind Malraux's statement that "Sacred art, and in a sense all art, imposes the presence of another world." Borobudur is an ancient temple in Java, a many-terraced pyramid having a stairway in the middle of each side. On the walls of its terraces are endless series of reliefs illustrating the life of Buddha. It was built in the 8th century, Indian in tradition, but Indonesian in essence.

STATUE FROM CHARTRES CATHEDRAL, SKETCH BY THE AUTHOR

Dante makes a strong demand on the artist when he says: "Who paints a figure, if he cannot be it, cannot draw it."

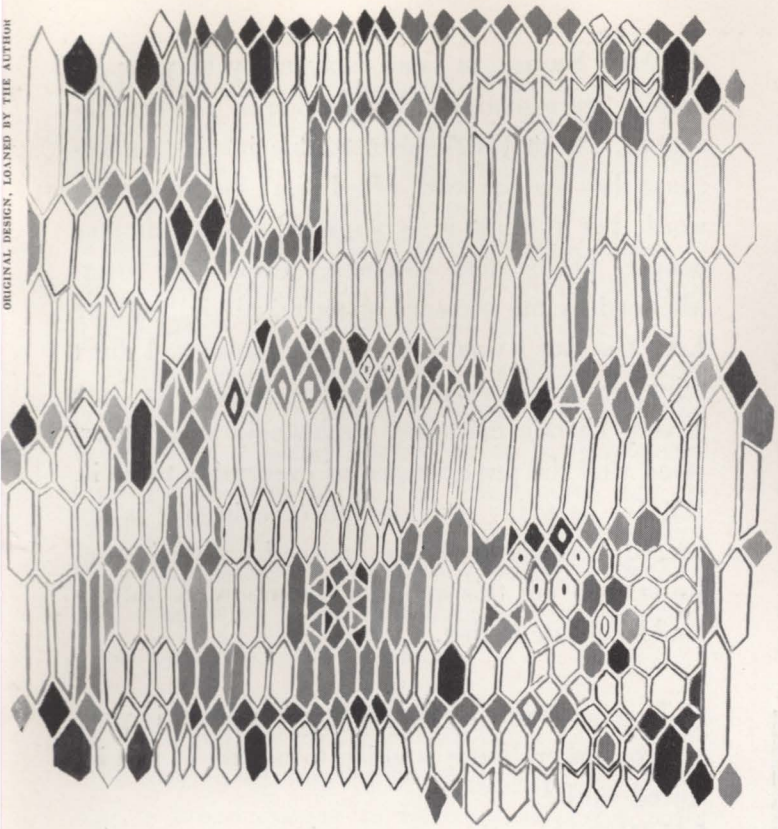


WALLPAPER DESIGN, LOANED BY THE AUTHOR

POLYCHROME KASHAN DISH, COURTESY OF THE SMITHSONIAN INSTITUTION,
FREER GALLERY OF ART, WASHINGTON, D.C.

Painting on Persian plate. An historic scene, done not in time or three dimensions, but in two dimensions. Asiatic artists recognize that a decoration—unlike a painting, which is a piece cut from the natural world—should be in two dimensions, and must be arranged within the size or shape of the object decorated.

ORIGINAL DESIGN, LOANED BY THE AUTHOR



Design of hexagons. The basic hexagon rythmically changes its proportion, to give variety as in nature.

RUG FROM COLLECTION OF THE AUTHOR

This cloth is a Toba-Batak Ikat from Sumatra. These Ikats are created by frail little women in an almost religious performance, with many rites, offerings and prayers deemed essential for their successful execution. Ikat is a technique where the warp or the woof threads are individually colored by the tie dye process, each thread showing different colors along its length in such a way that only when the cloth is woven on the loom does the pattern appear.

Cave painting from Altamira. In this rendering we can see how this ancient man caught the essential nature of the forms he painted. (See text.)

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INSPIRATION
A Conversation

Q. Miss Karasz, in your essay many of your examples are essentially the creation of older civilizations. Do they demonstrate this inspiration because they are the work of—I don't like to use the word, but I think it is appropriate—of simpler people, people less complex, people less overwhelmed by the pressure of technical civilization?
I.K. Yes, but I wouldn't say less complex. I don't think we have a very complex existence. We have a very chaotic existence. Prehistoric man understood well the pre-existence of everything there is. But for us today the question of existence is obscured, because we do not know why we exist and we seldom put this question to ourselves. But art could help us in that.

Q. In other words we are moving to a point, in your opinion, where there is going to be less of this inspired work?
I.K. I would rather say that in the way we live today, inspired work is practically impossible. Not possible unless with the firmest intention one sets out to find a meaning and source.

Q. You were saying that the problem of the so-called modern is that he looks at time rather than into himself.
I.K. I would not put it that way but his direction, his attention is toward, as it were, a tomorrow—a very personal and subjective tomorrow. But what is his model? Where does he get his shapes? It is often unrelated to any "order" outside or inside himself.

Q. Then you would say that though artists claim they are looking to tomorrow for their source of inspiration, actually they are unconsciously going back to their experience of life itself in order to get these things?
I.K. Here, really, there is no forward or backward

look. There can only be the now. What he, the artist, is able to experience as himself in the present. As the Tao says: "It is in us that God meets with Nature, and yesterday parts from tomorrow." There is no other place to look for inspiration except in this unique place that man has within himself, where nature and all new possibilities exist.

It is the artist's place to make contact with these possibilities and adjust them to our vision. But he could make it better known for us if he becomes more in the spirit of the way things come into existence. I would even say that it is an artist's place to anticipate nature's mode of creation, to foresee in a sense what is to be. But not to see it divorced from what is already created.

Q. Then you are saying that the artist must use his own sources of inspiration to present something that is broad enough to have meaning for more than himself alone?
I.K. Yes. He finds something right, something true and his presentation of it has to convey *that* sense. An artist has to understand not only what he experiences but also have the possibility of being able to evoke the same in another.

Art can be so very direct. It should affect a person like rain does. When you go out—you get wet. You see it is so immediate; and its effect should also be that of integration, not taking a man apart, as it were, but putting everything together within those confronted by the artist's work.

In a recent "Horizon," one part of this was made very plain pictorially. The author reviewed presentations of God and the saints and how in certain periods of time, like the late Renaissance or the late Grecian—when the "sense" of God was not imminent—things simply became flesh and blood rather than spirit. He showed a statue of an Etruscan god: looking at it, the proportions and the impersonal shape, one experiences majesty and dignity. Next to it was shown a late Greek god: it was just simply a human figure. The difference is where something really stirs within the artist. And that same feeling is evoked in another. Art is rarely used this way today. It is used more for self-expression. But what is the artist's self: associating ideas that just rise from his surroundings, his food, his notions? Or is there another self?

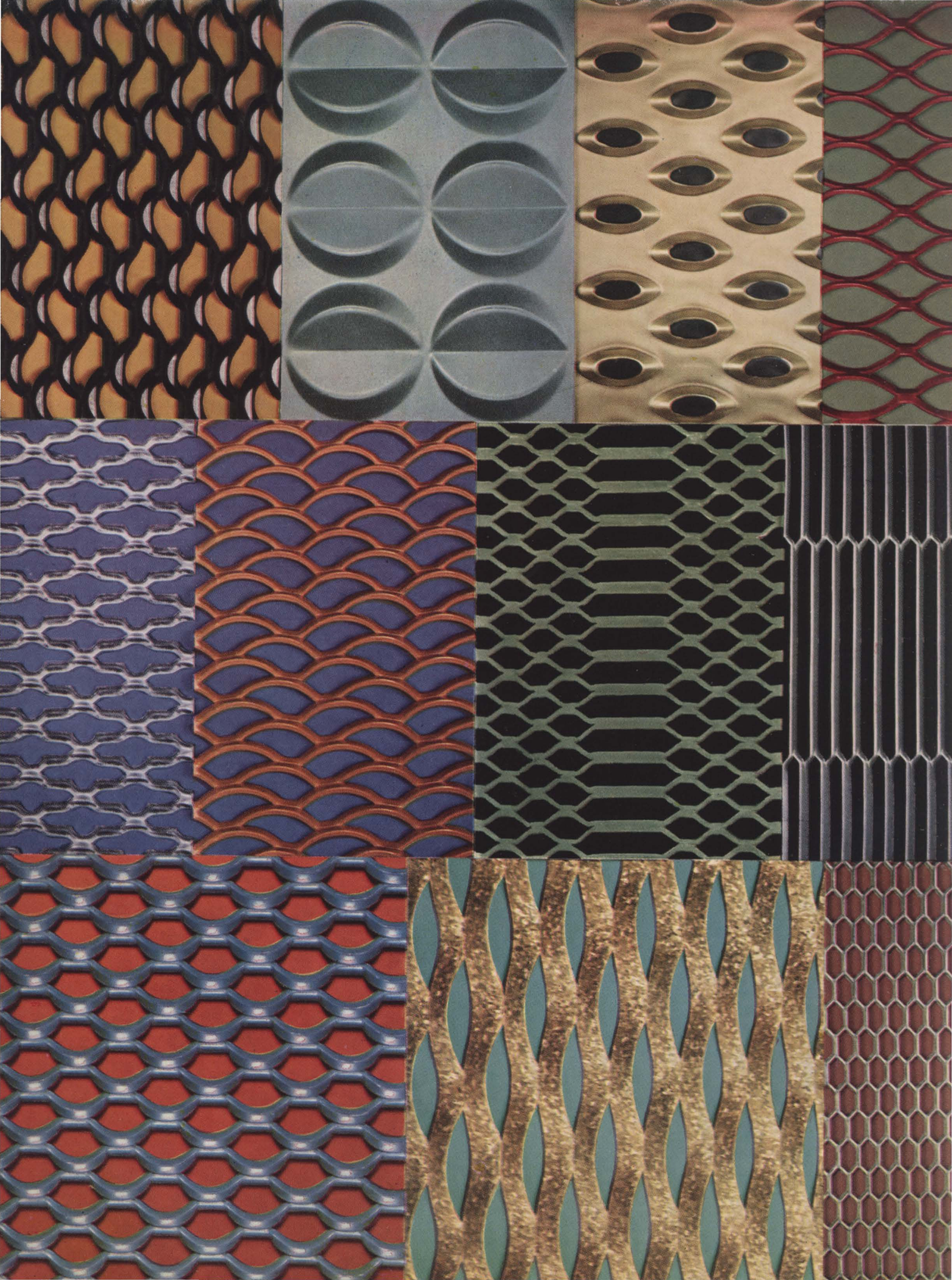
Q. What is the meaning of this for the designer of those things with which we live? Are our designed products inspired, or are they developed more for what we think of as a physical function of man today?
I.K. Today's designer thinks about how you lift something instead of what it can lift in you.

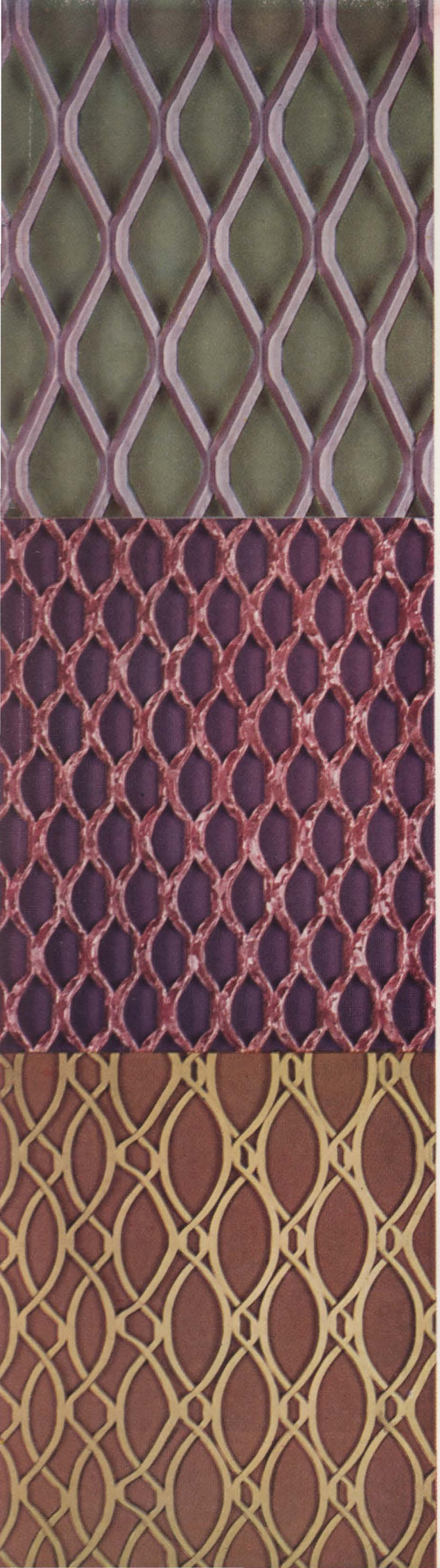
Q. Isn't the designer just logically—not necessarily desirably, but surely logically—doing these things which the civilization seems to demand of him?
I.K. I wonder whether civilization demands it of him or if he is forcing it on civilization.

Q. Do you feel that products need beauty in a spiritual and classical sense?
I.K. Yes, but I would not use the word classical, because that is limiting. It immediately gives you an image of the Greeks or whatever we know as classical. I would like to use the word traditional (this also has a bad connotation), but in this new meaning which I am trying to convey.

And in a sense we are not living in a bad time. Artists and designers are rather free of what is now only the corpse of what we ordinarily call "tradition." Many good and very alive things can and do "happen" today. But if there is a real inquiry within oneself, then there is a possibility of making these things "happen."

And thereby we achieve the proper sense or proportions for whatever is at hand.





PHOTOGRAPHED BY GEORGE WEISNER

MESH - MASH

Here's a pot-pourri of examples of the metal fabricators' art in forming and expanding aluminum sheet. These include mesh or expanded aluminum, and two samples of mesh-like patterns.

Some of these are available from stock, some on special order, some exist in experimental form only. What is significant, however: all of these patterns—and the many variations, permutations and combinations that the facile mind could imagine—all are capable of being mass-produced.

A word about size: the sky's the limit. (Or the ground.) Patterns shown are not in relative scale; they actually represent mesh openings varying in size from less than a quarter-inch to two or more inches. Important: any pattern that can be made, can be made in effectively any size, small or large.

How about finishes? Some possibilities are shown here. Most are anodized. Top left, the mesh is anodized black, and the highlights are sanded off. Two samples use the exciting potential of Alcoa's multi-faceted "Spangle Sheet."

Other tricks? Mesh in lower right is a complex of two patterns, flattened and spot-welded together.

EXMET 1102	ALCOA "Cupcake"	RIGIDIZED Experimental	U. S. GYPSUM "Rondo"	U. S. GYPSUM "Expand-X"
EXMET 2101	U. S. GYPSUM "Wave Length"	U. S. GYPSUM "Cathedral"	U. S. GYPSUM "Louver"	EXMET 1103
EXMET 1101	PENN METAL "Minimesh"	EXMET Grille	U. S. GYPSUM "Festoon"	

Manufacturers represented by samples shown in diagram are: Exmet Electrical Corp., Tuckahoe, New York; Penn Metal Co., Parkersburg, West Virginia; Rigidized Metals Co., Buffalo, New York; United States Gypsum Co., Chicago, Illinois.

REPRODUCED COURTESY OF "INTERIORS." COPYRIGHT 1958, WHITNEY PUBLICATIONS, INC.

Design trends:

ALUMINUM IN FURNITURE

JOSEPH PETROCIK

Pioneering industrial designers Paul McCobb and Charles Eames have long predicted that aluminum would one day rank with wood as the furniture manufacturer's most valuable material. Suddenly their predictions are coming true. Suddenly there is a vital movement afoot representing a major design step of our time—the introduction of aluminum furniture into the interior.

The movement is, in reality, a renaissance. Aluminum furniture made its debut into the home in the late twenties, in the form of mass-produced chairs and tables with cold, hollow metal supports, which, unfortunately, overstressed function at the expense of good form. The result: a quick death for the furniture, a stigma of coldness and impersonality for the material. Creations in metal which followed were designed specifically for the out-of-doors. For the interior, with few exceptions, they were considered déclassé.

Today we see a dramatic new image of aluminum in furniture design. What was once "too cold to handle" has become "too hot to miss." Brilliant dimensions of function and beauty are appearing in aluminum furniture design. They are the result of imaginative styling, technological research, the use of new casting techniques, the introduction of color through anodizing processes, the development of paints and lacquers, and the cooperation of the aluminum industry itself with the designer and manufacturer.

With its myriad of forms, textures, and colors, and its remarkable versatility in being able to resemble, in both durability and beauty, wood, gold, brass, wrought iron, or virtually any other common material, aluminum is becoming established as a major material in contemporary furniture design.

On these pages are examples from the work of some twelve leading industrial designers who have been exploiting this miracle metal. They have explored some of its infinite possibilities and the results can be seen in designs sometimes sleek and sophisticated, sometimes light and graceful in appearance and feeling, sometimes classical, or casual, but in each instant warm and durable.

DONALD DESKEY

The trend toward employing aluminum as a material in furniture design is handsomely illustrated in this setting of Charak Modern *by DONALD DESKEY. The collection's unifying motif—reminiscent of Brancusi—is a sculptural cast aluminum base, with a reflective, highly polished finish. This beautiful, distinctive form serves as base for both chests of the breakfront, takes on tapering elongated height as base for the end table, and extends into a graceful cradle as support for both chair and sofa.*

GENERAL FIREPROOFING

Italic Styling—*a new concept in business decor by the GF STUDIOS of General Fireproofing—weds light, airy appearance with sturdy, welded construction. Desks and chairs have straight, crisp lines combined with subtle curves, are featured in pleasing array of shapes, textures, and patterns. Each piece is nicely accented by color-anodized aluminum, in bronze gold, ebony, antique bronze, or natural finish. Aluminum extrusions, forgings, tube and patterned sheet are used to assure long-lasting durability.*

CHARLES EAMES

Chairs and table from Cast Aluminum collection designed by CHARLES EAMES for Herman Miller. Universal and elegant in quality, collection is designed effectively either for interior or exterior use. Cushioned pads of Naugahyde are held in tension between two frames of polished aluminum. Back and seat of chair form graceful, continuous thin line; horizontal spreader at back serves as convenient handle. Coffee table has cast aluminum base with top of Botticino marble.

GEORGE NELSON

GEORGE NELSON's "Omni" Universal Space-Maker System, *winner of the American Institute of Decorators Award for 1959. A light framework of anodized extruded aluminum, equipped with a variety of clips and fittings, forms a simple construction system suitable for easily installed storage space and room divider schemes. The aluminum poles, reaching from floor to ceiling, are independent of wall mounting. A product of Structural Products, Inc., each basic unit is composed of square slotted poles for installation with spring mounted hardware and adjustable shelf brackets.*

DONALD DESKEY

Charak Modern *desk by DONALD DESKEY has tambour cover of alternating light and dark walnut strips, separated by slender aluminum ferrules, over slide-out polychromatic Micarta writing surface. Inside has cork tack-up panel, small drawers, pigeonholes. Desk is supported on sleek cast aluminum form, brightly polished and coated in clear plastic base lacquer. Two years of research preceded the combination in* Charak Modern *of the distinctly different materials: aluminum and Micarta.*

JOHN VAN KOERT

Armchair from "Cymbal" *collection of Troy Sunshade Company, designed by JOHN VAN KOERT, is light in scale, has scroll arms, sculptured form and decorative motifs at right-angle corners. Made from specially designed extruded aluminum frames—slender, square-shaped pieces with sharply mitered corners and simple, straight legs—chair has gold-anodized finish antiqued in choice of four colors. Each square piece of aluminum is modeled with four concave surfaces that add richness and result in interesting light reflections and shadows.*

KNOLL ASSOCIATES

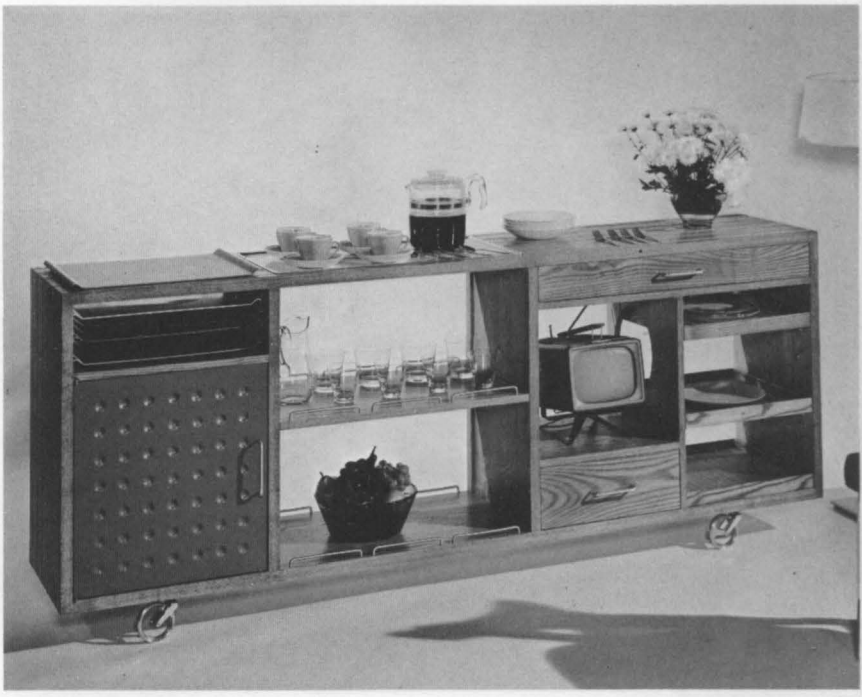
One of the Alcoa Building's 250 offices, conference rooms, secretarial centers and reception areas designed and decorated by Knoll Planning Unit, under the direction of FLORENCE KNOLL. Since aluminum was used throughout, special design engineering of all Knoll products supplied was necessary. Chairs with aluminum legs are famous classic design of Eero Saarinen. Desks, tables, cabinets, and accessories by Mrs. Knoll.

PAUL McCOBB

Dining pieces from the Linear Group *designed by PAUL McCOBB. Pedestal table has cast aluminum base, walnut-grained plastic top. Dining chairs with shield back are made of solid walnut with caned seats. Says McCobb: "Beyond all doubt, the rediscovery of the versatility of aluminum is the beginning of a new and exciting trend. Its cool handsome look . . . will unquestionably be further developed . . . for tomorrow's home."*

EDWARD J. WORMLEY

Party Cart *in aluminum and ash with gray finish designed experimentally by EDWARD J. WORMLEY for Dunbar. Top of cart has horizontal inlays of aluminum a fraction of an inch over the wood, to protect wood from hot dishes. Easily mobile because of large aluminum wheels, and workable from both sides, unit contains aluminum hot tray and servers. "Aluminum," says Wormley, "in all its varied forms, and allied with the technologies for each, offers a stimulating tool for the future. We have only just begun to realize its potentials in structure, sculptural qualities and color."*



JOHN VESEY

JOHN VESEY's luxurious, costly Maximilian Group: *high-backed sofa and chairs of polished aluminum and tufted top-grain calfskin leather. Aluminum is wrought, not cast; frame of each chair or sofa is one solid piece. Basic upholstery support is a mesh woven of aluminum wire—a new material for this purpose —light, strong, noncorroding.*

WALTER DORWIN TEAGUE ASSOCIATES

Cadet Room *designed for U. S. Air Force Academy by WALTER DORWIN TEAGUE ASSOCIATES. Dressers, beds, study desks, chairs, and bookcases are walnut and anodized aluminum, with all horizontal surfaces light gray melamine plastic. Room is duplicated 1,320 times, making up some two miles of bedrooms. Basic contract requirements set down by Air Force: economy, standardization of equipment, compatibility with architecture, equipment design and selection that will withstand 50 years of use—meaning not only durability but enduring design and minimum maintenance as well.*

DON DAILEY ASSOCIATES

DON DAILEY ASSOCIATES' Imperial Desk *has structural legs of extruded aluminum which, combined with wooden panels, provide simple assembly of metal components to variety of office furniture pieces. "A major appeal in the design," says Dailey, "is that finished sections of the drilled and anodized extrusions can be purchased and inventoried against production assembly. For Imperial, a long-time manufacturer of wooden office furniture, there was no need to invest capital in metalworking equipment. Wood production facilities were not disrupted."*

GEORGE FARKAS

Skillfully crafted of square-shaped aluminum tube, Lawnlite's Pompeian Teacart *by GEORGE FARKAS is buffed to mirror-bright finish, then lacquered. An example of function combined with exquisite design, the teacart was chosen for display at last summer's U. S. Exhibit in Moscow. Its dimensions: 29" high, 18" wide, 33¼" long. Its weight: 43 lbs. Says Farkas: "The wonders being worked by design, development and engineering divisions of aluminum companies make aluminum today's aristocrat of inexpensive metals."*

RICHARD S. LATHAM
Partner, Latham-Tyler-Jensen

DESIGNER, CLIENT, and the MARKETING MYTH

This is a book about design. When you look through it, you will see objects that have been shaped from materials into products for many useful purposes. If you are a designer, you will react to what you see and judge it. Your judgments will be based on aesthetic standards, possibly abstract in nature, but certainly very real to you. Of course, your unspoken ultimate judgment will concern whether or not what you see provides a "good" solution of the problem in your terms.

Will your judgments be made in the same terms as the art critic's? I doubt it, for the practice of this very peculiar business of industrial design gives you a special set of insights—insight into the environment in which the problem was solved, into the relationship between designer and client, whoever they may be, and into the business world that every designer serves. And all of this gives you quite a different frame of reference from the wholly abstract one, that of art as an aesthetic expression.

This difference interests me. Why do you—and I—judge design differently from those whose interest is only aesthetics? Is this different outlook part of a permanent change in our vision, resulting from the real experience of designing in a business context? Does this explain the gap between a "good design" exhibition selected by museum curators and a "good design" exhibition selected by practicing designers? For surely there is a gap, a real difference of judgment. The question to my mind is not "Who is right?" but "Why the difference?"

Within this question lies a whole world that needs exploring. Design in America today is practiced as a business relationship between certain individuals with skills for hire, and manufacturers who hire them. Can we find in the skills of those individuals an explanation of the difference between a Ferrari GT and any American automobile? Do they account for the fact that a piece of industrial electronics equipment expresses an elegance of material and a quality of form that makes its cousin, the consumer

product, look a little cheap, a bit flashy, and somewhat devised?

It is my feeling that these differences cannot be explained by individual skills alone. They seem rooted in something more nebulous but much bigger and more important: the relationship between designer and client, and the way these two participants view each other and the world around them. I would like to suggest that something about this relationship produces a basic failure in the designer's performance for modern society—if "failure" is interpreted to mean a breakdown in the quality and appearance of products. A great many ugly things are being created, and a variety of dull solutions are coming forth, not because they *have* to, but because no one is stopping them. It seems to me that the discrepancy between design and art may also be accountable to this relationship. Most bad design which is charged off to public taste should be charged up to the designer and his business partner.

I believe that the artist creates an aesthetic reality in terms of his own needs. The result must satisfy him first, and if other people respond emotionally to this, so much the better. The artisan, on the other hand, creates things for others. It is his premise that his work must satisfy another man's problem first; if he can also satisfy his own aesthetic judgment by creating something he considers "right," this is a secondary achievement. If, in either case, the solution happens to satisfy both the creator and the audience, the result is great art, or in the artisan's case, great design.

But are these distinctions really meaningful today? The cleavage between the creator of "pure" or decorative art, and the maker of useful art, has been with us only a few hundred years, yet we tend to look upon it as historical. In a machine society, artist and artisan have had such an increasingly hard time maintaining the difference, that it has created a suspicion of something the medieval artist-craftsman knew well, namely that the cleavage is artificial. In a modern society that demonstrates its cultural standards through product wealth more than through art, the artist feels frustrated and misused. In the same society, the designer gradually discovers that the products he creates are having an effect on the public's aesthetic values, and finds himself in a confusion of loyalties. Who should he answer to, the public or his client? And more important, does his artisan's training equip him to take over the artist's responsibility for the aesthetic standards of his society?

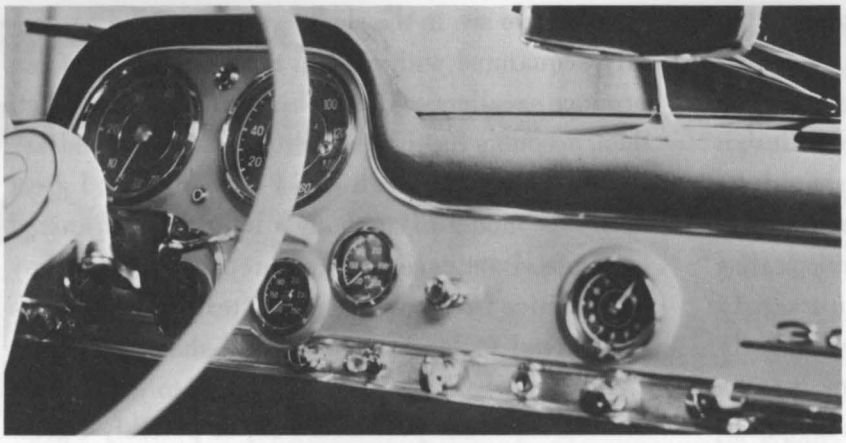
I don't doubt personally that a great many designers are well equipped, not only with artistic ability but the introspection necessary for progress in their work. I even feel sure that many of Detroit's designers are capable of much more artistic integrity than we see in the showrooms, for I am personally acquainted with men in that industry who can produce excellent sculpture by any standards. What, then, accounts for the absurdities we see around us?

When I say "absurdities;" I must qualify. I greet each new model of anybody's industry with mixed emotions. I am curious, yet I prepare to defend my sensibilities from color schemes, textures and forms which tend to leave me pale and shaking on first sight. But what is worse, they seem to grow more reasonable as the year wears on, or possibly I grow more indifferent, until I hardly react to them at all. What is happening to my standards is apparently par for the public course. New extremes each year tend to modify our view of earlier absurdities until they are practically invisible. Yet measured against themselves, and by their own inherent standards, the absurdities remain, to clutter our lives like tired, bloated ghosts.

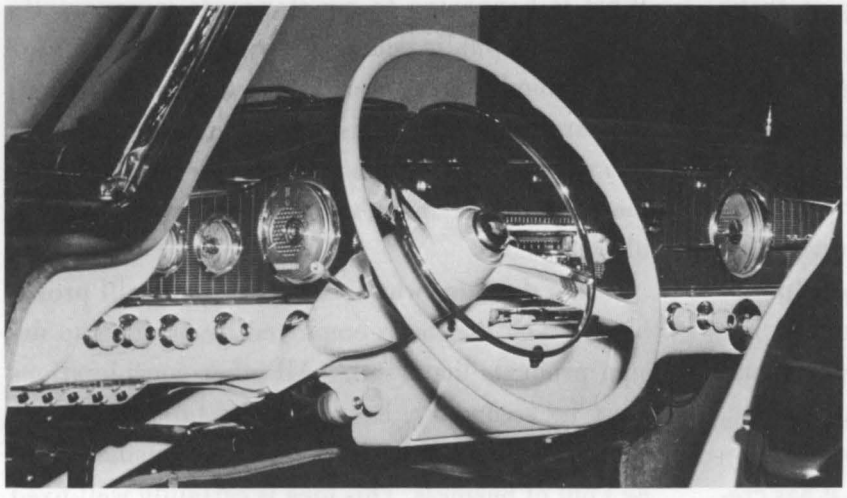
Ask a designer why this happens. He will probably tell you that he is employed by business to design products that "sell." All other considerations must be secondary, because if he fails in this responsibility to sell he is of no use to business, and *he's* out of business. This idea is certainly well-fixed in the mind of both designer and businessman. What is not so well-fixed is an understanding of how best to apply the designer's skill for business. In order to sell, must the designer forego standards in his work?

DASH CLUSTERS

An example of contemporary design which has to do something (be legible) as well as look like something. The simple austere dash panel at the top is what the pilot of a Scarab sees at 100 m.p.h. This is a very fast and pretty car and this panel was designed to work, for at these speeds it's a matter of life or death.



The center dash cluster has obviously been designed to look well. This is a Mercedes 300 which combines racing qualities with the comforts of a street vehicle. To my mind, its designer has accomplished the same successful compromise between function and aesthetics as has its engineer.



The bottom panel is an example of what happens when a dash cluster is styled. Possibly the texture is for striking matches (kitchen variety). The only instrument which conveys any information of a higher order is the speedometer which through crowding, light background and a run-through indicator manages to violate almost every rule for snap reading at high speed. The general character, however, is no more meaningless than most kitchen range heads from which it was borrowed.

And whose standards—the critic's? the businessman's? the public's? or his own? And furthermore, what is selling? Is it a process of supplying useful objects to a society that needs and wants them? Or is it a device invented to perpetuate sales volume by the sheer movement of goods?

Within these questions lies a hint of the confusion business has about its role in society. The designer is caught up in this confusion quite often, explaining his actions with phrases that he did not invent and does not fully understand.

One of those phrases is "marketing." Many people believe that ours is a marketing society, a culture that has grown materialistically to the point that everything becomes secondary to buying and selling. The health of the economy depends on the simple fact that every morning everyone goes out and buys something, and it behooves the businessman to see to it that his product is the one bought. The great effort expended to this end, known as marketing, results (he hopes) in selling. One part of this effort is the hiring of a designer, and I would conservatively estimate that most businessmen hiring designers believe that their vital contribution is to the marketing process.

So the designer becomes a salesman and a marketing expert. And how does this affect his work? If he feels compelled to concentrate on the elements that work in a selling atmosphere, he reaches naturally for stylishness, brightness, or an arresting gimmick, for these speak louder than logic and integrity. If he is involved in distinguishing a product in a pattern of annual model change and prestige lines, he literally stands on his head looking for ways to create visible differences that in many cases look as if they were designed upside down.

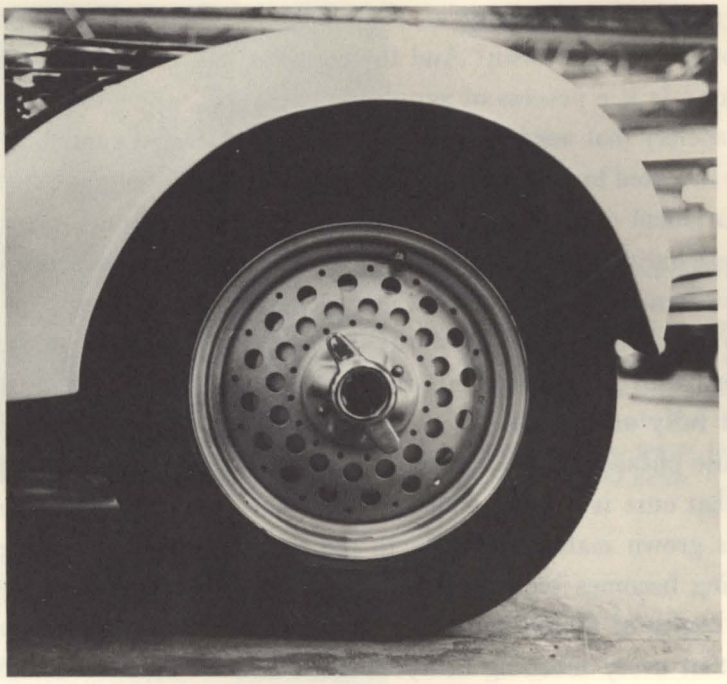
We know that any artist trained to create good sculpture cannot create it on a progressive basis for release by the calendar. And he does not create it to visually scream louder than every other piece in the gallery. He is practical. Suppose, for instance, someday, someone should like it, buy it, and decide to take it home and live with it?

For the designer to have become a working tool of the marketing process is not necessarily bad. The appearance of a product is certainly one of the parts that contributes to marketing success. What is dangerous is that he has lost his perspective of the total reason for design, and allowed his work to become only a device in the marketing process. It is used to perpetuate the myth of styled obsolescence, which attempts to convince people of something that is not true. In the process of accomplishing these petty deceits of selling for selling's sake, I believe the designer has also convinced himself of something that is not true: that to be worth something, he must sell something. He has sold himself short, and in the process, he is selling the consumer short, too—the man who needs a product, sees it, buys it, and then has to take it home and live with it.

Presuming this is true, the question remains, "What, if not marketing, is the designer good for in modern business?" What place have "beauty" and "aesthetics" in a hard-boiled business relationship geared to selling? I believe they have a very large place. I believe they are the central commercial reasons why designers are being employed today. I suspect that businessmen know this—however inarticulate they may be about it—much better than the designers themselves.

Designers may have good reasons for pretending to the talents of merchandising and selling. But they have no reason to conceal the fact that they have trained aesthetic sensibilities and reactions of their own, and that they can and must express these values in their work. Businessmen have slowly discovered this truth—and value it. The designer's skill is the only one in the product-making process that is responsible for aesthetics. And it is in this area that the designer comes closest to being an expert, and more entitled to judgment than anyone else. When he expresses an opinion, he is listened to with respect. But too often he doesn't express this opinion, because he is confused between what is good and what will sell.

We must eliminate this conflict between "art" and



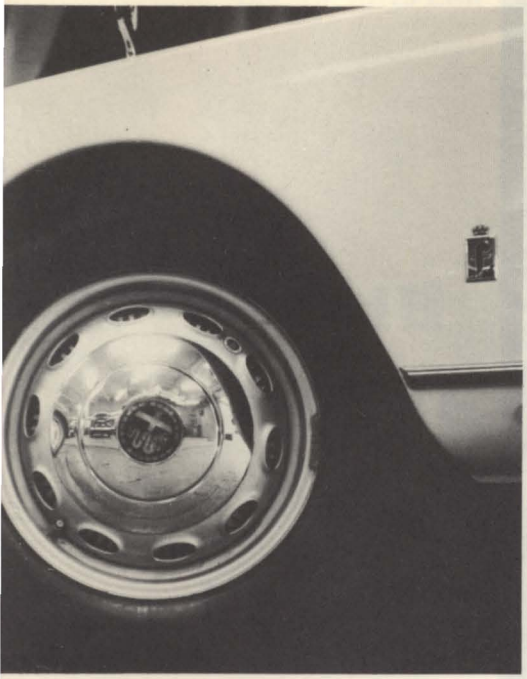
WHEELS

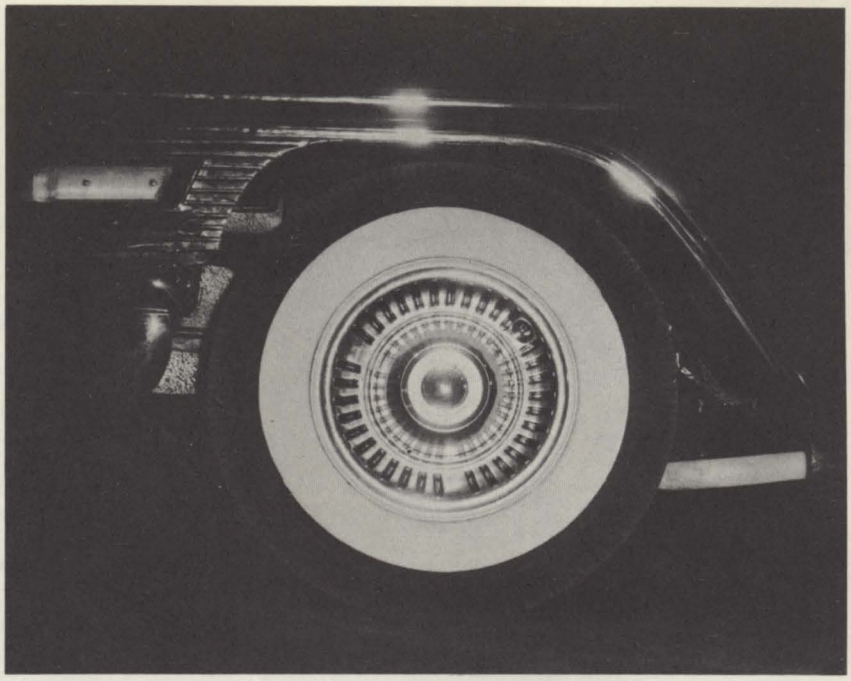
And here we have wheels, a very necessary item on any present day car. The world is full of beautiful wheels of one sort or another, but along in the 1930's the stylist discovered them, and today it is almost impossible to remember what they looked like. The wheel at left is on a BMW, a car designed to go exceedingly fast and stop quickly. The holes allow air to cool the brakes to eliminate brake fade, so the car will stop every time.

The wheel in the center carries the Alfa Romeo Mark and shows what happens when a designer sets out to organize cooling holes for an aesthetic effect. Also, a thin flat cover has been added over the wheel lugs, a very clear statement of a part known as a hub cap.

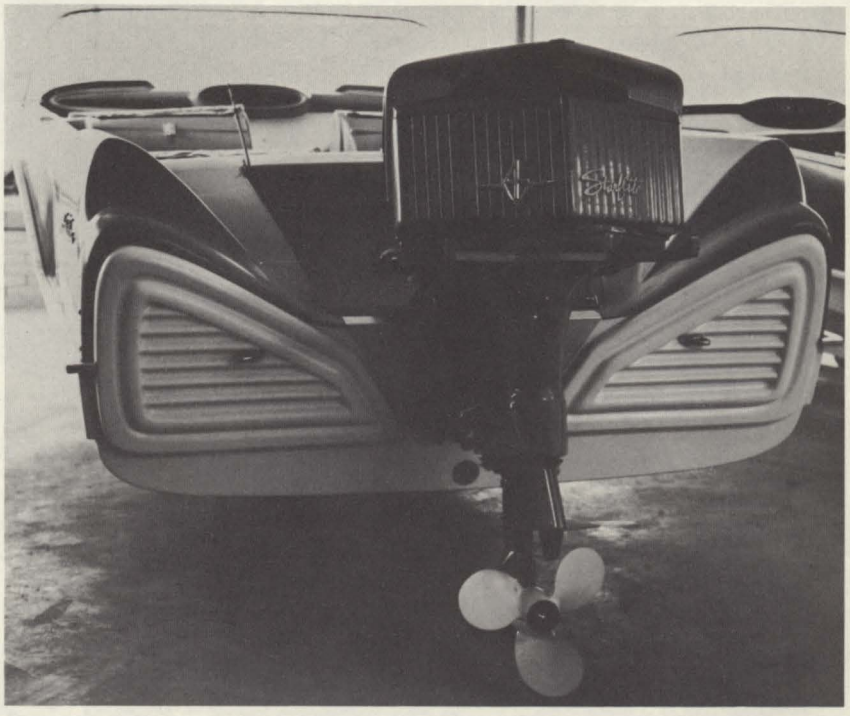
The photo at right speaks for itself. This is what happens when the stylist scratches his head for a new effect. This is actually a hub cap grown up into a cross between a turbine rotor and a vegetable shredder, trying desperately to look sleek and sporty, but somehow managing only to look confused.

"design" and between "private" and "public" responsibility before we can produce a mature level of work. It shouldn't be hard, for the conflict exists mainly in our own minds and must be resolved there. We have responsibilities to *both* sides. The only way we can actively discharge the responsibility, as I see it, is to achieve the arrogance of the artist, growing out of the humbleness of the artisan. If we stop hiding behind what is "good for people," we may achieve something that is as good as we can do. If we stop our amateur attempts at mass mind-reading and examine what *we* find to be good or bad, we at least stand a chance of creating something more meaningful for both ourselves and our audience. We are being paid for our convictions as designers, and our courage as synthesizers. Let the marketing experts stick to the drum roll and pitch. What we have to do is a lot harder—we have to put a bottle of real tonic in their hands.

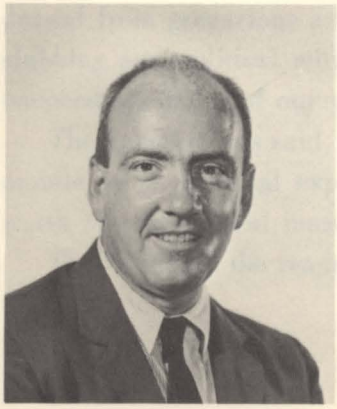




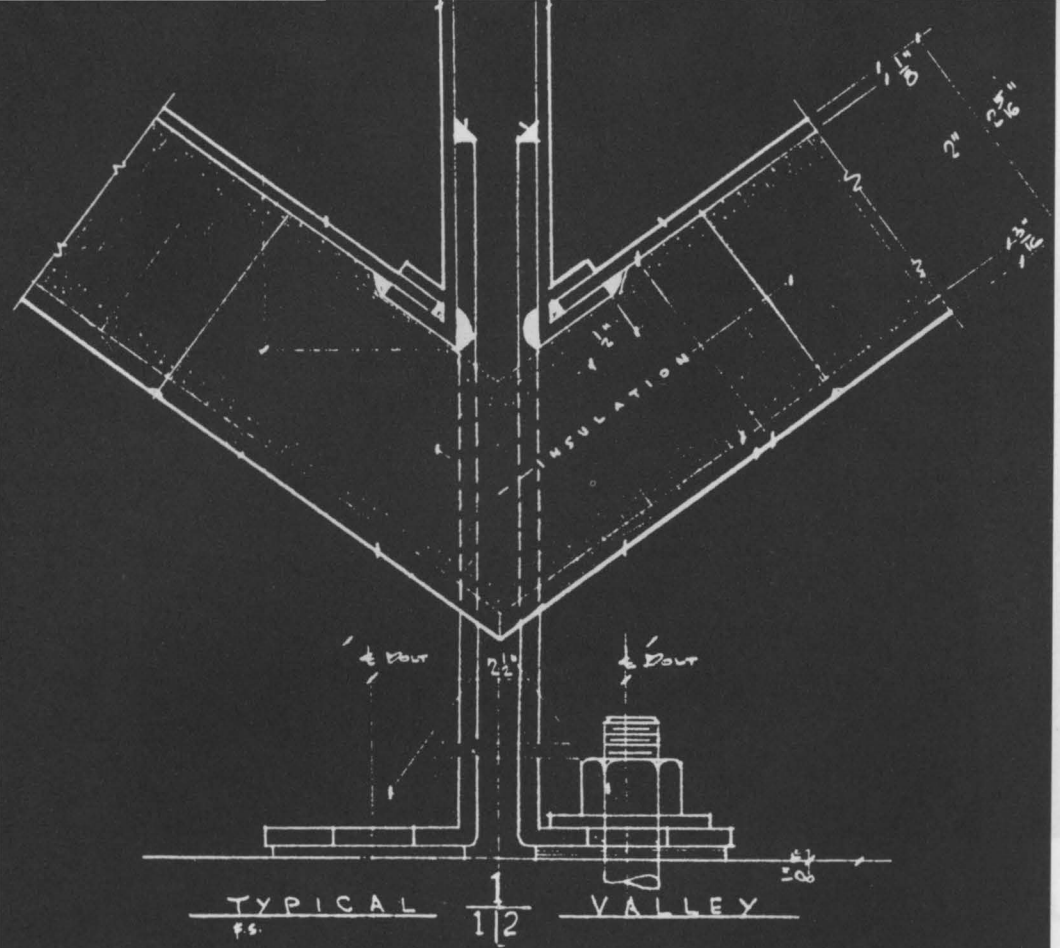
BOAT AND MOTOR



How can you comment on this? The name STARFLITE makes it obvious that this entire machine goes through the air, somehow, or something.



Richard S. Latham, a designer since 1940, has been a partner in the Chicago design firm Latham-Tyler-Jensen, since its founding in 1955.


INSULATION
TYPICAL VALLEY
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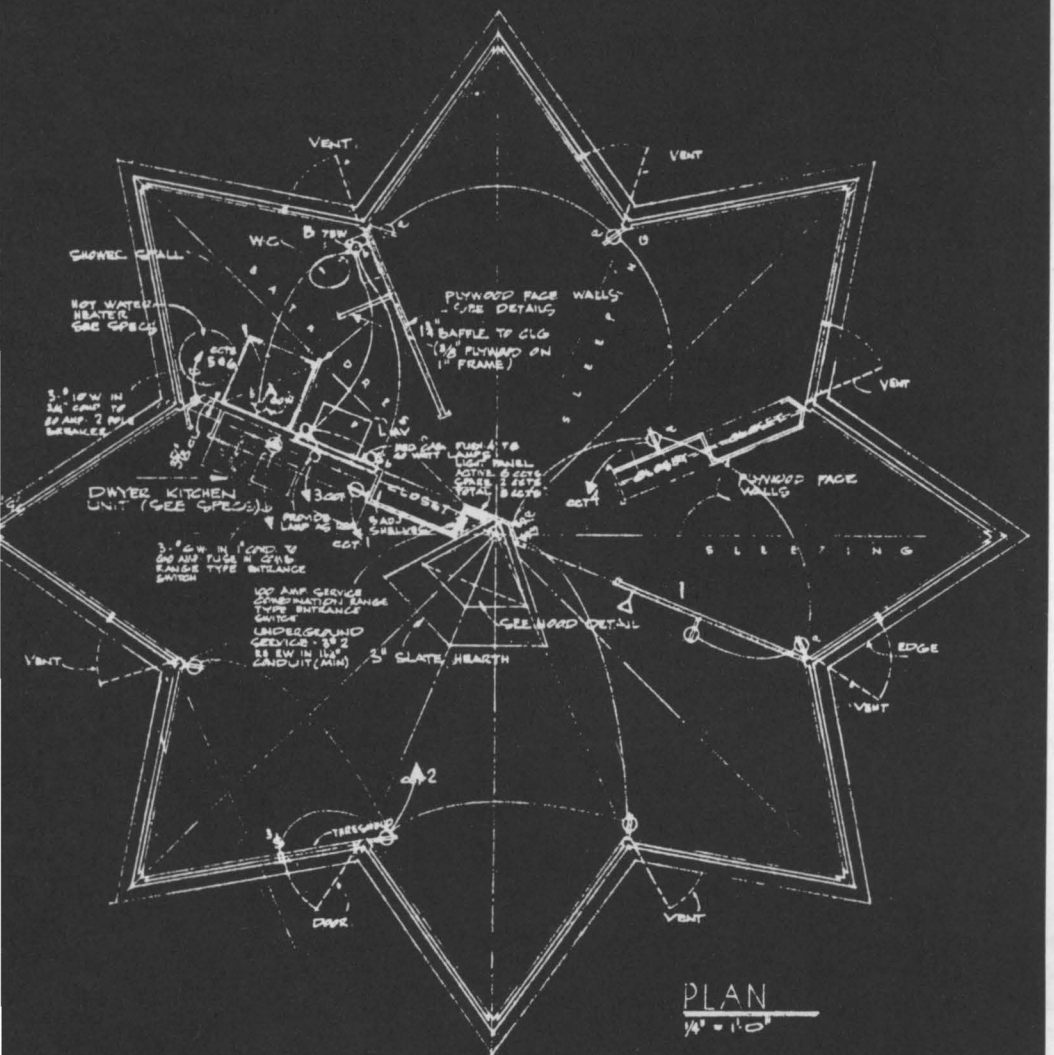
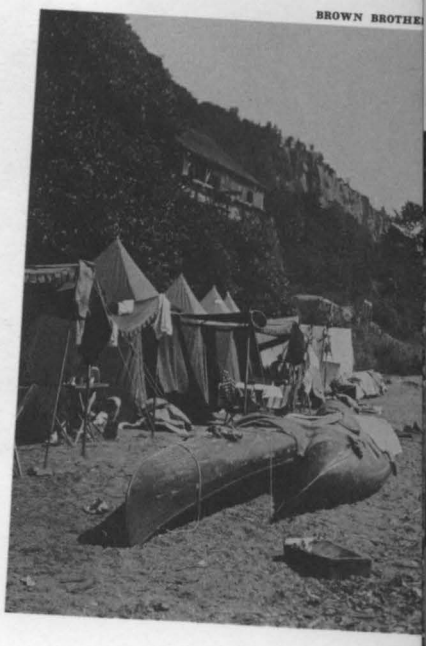

VENT
W.C.
SHOWER STALL
HOT WATER HEATER SEE SPECS
PLYWOOD FACE WALLS - SEE DETAILS
1/2" BAFFLE TO CLG (3/8" PLYWOOD ON 1" FRAME)
DRYER KITCHEN UNIT (SEE SPECS)
CLOSET
SLEEPING
PLYWOOD FACE WALLS
SEE WOOD DETAIL
3" SLATE HEARTH
EDGE
DOOR
PLAN
1/4" = 1'-0"

OSCAR SHEFLER

THE HOME THAT IS NOT HOME



John Fischer, the fluent editor-in-chief of *Harper's* magazine, recently predicted—or had a character of his invention predict—that the home would come back into its own as America's Number One status symbol. Said Fischer, or his alter ego:

"It will betoken the owner's social standing, not by any measure so crude as price alone, but by a whole set of more subtle indicators—the quality of its architecture, the layout of its garden, the pictures on the walls, the nature of its library and record collection. This phenomenon is of course closely related to the turning inward—the withdrawal from gregarious activities, including nightclubbing and political movements, which are pronounced attributes of our younger generation."

The home, it was said, would replace the automobile as a material expression of the owner's worth (in the several meanings of "worth").

This intrigues the reader, for one aspect of the automobile's reign as a status symbol was quantitative. What was the next logical step, after one had acquired a car as fast, powerful, gaudy, expensive and compliant as one could? In short, what could be better than one of the best? The answer was obvious: two of the best.

The analogy is not impossible. No longer does it require an impermeable layer of wealth to have a second residence remote from the main establishment. By summers and by week ends, the highways hum with cars rushing their owners along the happy rut from one dwelling box to another. The significant thing is not that the minor domicile echoes the virtues of the major as to the necessary apparatus for preparing food, mixing drinks and disposing of waste. What is important is that it has these things within sight of woods, within sound of surf, amidst the scent of leaf-sweetened air.

The condition will grow. Envy is a factor. So

EWING GALLOWAY

WIDE WORLD PHOTOS

H. BOWDEN

are some practical matters, such as the expense of perennial vacation trips, and the desire to spend one's leisure under conditions that conform better to preference. But perhaps most compelling is the fact that the owner is restricted in what he can do to improve the place to which he returns on ten thousand evenings of his life. The possibilities have been frozen by the limitations of the lot, the structure of the shell, the habits of the inhabitants. And yet there is the restless desire for rearrangement. Who—or whose wife—that has built once, has not yearned to build again?

It is a time to cleanse the mind of clichés. And no one is better equipped than the designer to joggle thought.

Consider the common picture of the second home.

The seaside cottage.

The hilltop cabin.

The shanty in Shangri-La.

The pesthole in paradise.

Reluctant plumbing.

Kitchens that would be a source of shame in a city slum.

Heating, if there is heating, on minimum terms, in grudging acceptance of the fact that summer sometimes borrows a day from fall.

Decrepit furniture, come to the country to die.

Lighting not much greater than that used to guide sleepy children on their midnight shuffles between bed and bathroom.

The total: such a patchwork of frustration that the designer is wise to turn away from it and start with a clean sheet.

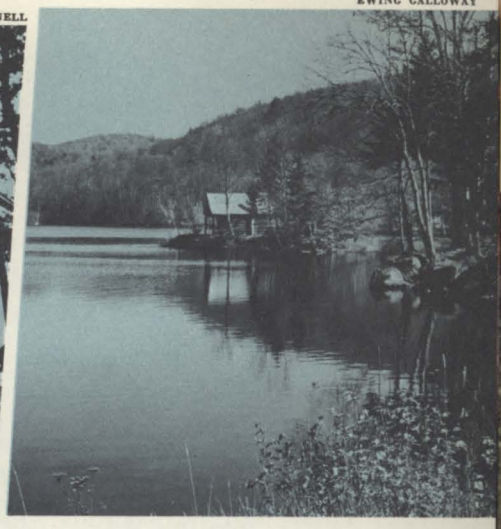
Thus did Robert Fitzpatrick.

It was Fitzpatrick's approach that the summer house should be "an exciting experience," and that it should "exploit aluminum to its utmost capacity." He arrived at a pattern of folded panels, similar in feeling to certain patterns of folded paper. The folds were plotted so that the panels would work against each other. The panels, made by sandwiching foam insulation between sheets of anodized aluminum, serve as both roof and wall-ceiling, and

WIDE WORLD PHOTOS

BROWN BROS.

FRANK E. GUNNELL


EWING GALLOWAY

are susceptible of mass production.

The Fitzpatrick design, viewed from any point, is complete, with a circular completeness, yet not so obvious as a circle. This sense of perfectness is not uncommon in design, but it is fairly uncommon in the design of dwellings. Most dwellings seem to suffer the phantom pain of the amputee, with implicit extensions spreading ghostly in various directions upon the landscape. Not so Fitzpatrick's. It goes about and comes back to itself, and gives no sign of proceeding elsewhere, or of wishing that it might do so.

The beauty of the structure consists not alone in its intrinsic aesthetic worth, but in the preservation of a good relationship between it and its natural setting—whether the setting be dominated by leaf, sand or stone.

The mechanics of the house influence the design and rise out of the design. Plumbing and utility lines, for instance, are contained within the terrazzo slab on which the structure rests, making it possible to rotate the house in order to seek or escape the sun, moon, wind or whatever.

Wallace Harrison observes (but does not applaud or deplore) a trend. "The larger buildings," he says, "are now about half enclosure and half mechanical plant. The ratio used to be much higher in favor of enclosure."

The trend runs similar for residences. "What is an air-conditioned house," he asks, "but a giant refrigerator with a view?"

This does not diminish the designer's importance, but does require a new statement of his function. It is not likely that houses will ever be measured by horsepower instead of area; just the same, the design of a house involves more and more a skill in the placement of openings. Where does it plug in? asks the owner at his blueprints. Where does it come out? These are questions both cosmic and specific.

The Forecast summer house has the moderating force that all beautiful things exercise upon their environment. Just as denims and diamonds do not mix, so does the summer house resist the intro-

R. GATES

duction of unworthy accessories. Within its bright interior, one does not set a mouse-chewed sofa. Against its crisp outer walls, the stiff-dried mop is unthinkable. The effect is like that of an elegant lady in a crowded room: the women sit straighter, the men lower their voices, all elements seek to conform to the paragon.

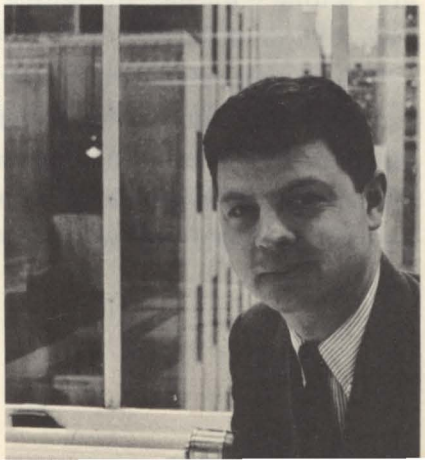
Here, of course, might be found an objection. Might not such a summer house defeat a frequent objective of the vacation, which is to permit a complete abandonment of responsibility, including the responsibility for hanging hats on hooks? Some merit must be granted to this argument. Yet it must also be argued that comfort and the look of comfort are not always the same. A dripping swim suit in the conventional summer house will warp wood, streak linoleum and offend the eye. In the Forecast summer house, it may still offend the eye, but at least will not cause warp or streak.

There are, let us face it, persons to whom the making of slums is as natural as breathing in oxygen and expelling carbon dioxide. To the slum-makers, there is no such word as unspoilable. Thus it is useless to speak of a design as being completely person-resistant. And yet the Forecast summer house makes a fair start, first, toward discouraging acts of degradation, and second, in minimizing such acts when they do occur. It is likely that a million such structures would effect a considerable elevation in the standards of Americans as regards the environments in which they would propose to spend their leisure. Like all things that express beauty, including certain humans, they would instruct merely by being.

It must be said immediately that a virtue of the Fitzpatrick design is its uniqueness, and that its purpose therefore is not to inspire duplication. Begin with the original problem. Fitzpatrick was charged, and took it upon himself, to create a design that would employ a given material for a stated purpose in an unspecified form. The form was to be pertinent to human use, as a dwelling suitable to the condition of rest and recreation. As far as it was possible to do so, the designer shunned preconception. Out went all thought of post and beam. Out went even the relatively new concept of the curtain wall. Doors and windows were regarded in terms not of form, but of their basic functions: to permit or prevent the passage of persons, other living things, inanimate objects, light, heat and air.

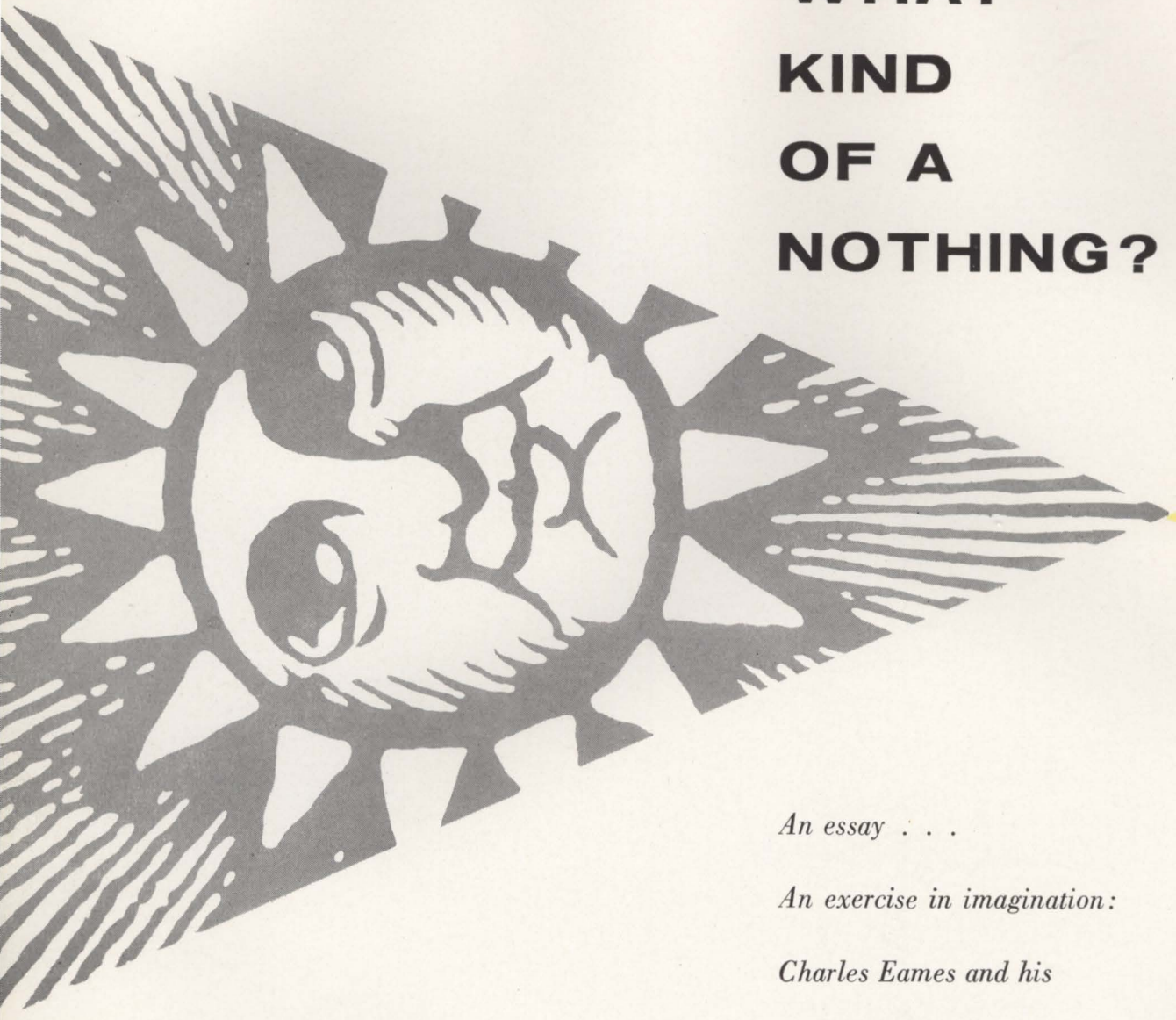
That much was accomplished. Also accomplished was a demonstration that old uses may be satisfied by new modes. What signified was not that such and such a solution was arrived at, but that solutions were possible other than those theretofore presented. One remembers that Columbus cracked an egg and stood it on end. The result was not that millions more of eggs were cracked and balanced. The lesson, in fact, had little to do with eggs. There on a table in Spain it was dogma that was cracked. It was a habit of thinking, crusted by the centuries, that was finally brought back into balance.

EMMA LANDAU



BERT STERN

Robert Fitzpatrick was born in Queens Village, New York, in 1924. He studied at Pratt Institute Architectural School, where he acquired a bachelor's degree in architecture and design. In 1953, after a short period of employment with a Philadelphia architectural firm, he returned to New York and joined the staff of Harrison & Abramovitz, which had designed, among other structures, the world's first aluminum-clad skyscraper — the Alcoa Building. Years passed. Then one day Alcoa asked Harrison & Abramovitz to create something for its Forecast program. The firm decided to throw the assignment open to its staff. It announced a competition for the best entry.
Robert Fitzpatrick won. His summer house, with its floor plan in the form of an eight-pointed star, has been described as "a crown jewel on the landscape that wears it."



WHAT KIND OF A NOTHING?

An essay . . .

An exercise in imagination:

Charles Eames and his

FORECAST Solar Toy

OSCAR SHEFLER

Eames is a chair of molded plywood and metal. Eames is a bright-colored kite, a crisply arranged showroom, a remarkably communicative film about communications. Now, Eames is a solar toy, powered by a fuel source ninety-three million miles away.

The Eames, of course, is Charles Eames, born in St. Louis, educated (as an architect) at Washington University, and at Cranbrook Academy of Art, where he worked and taught under Eliel Saarinen. He and his wife, Ray, in partnership, operate a busy studio in Venice, California, not far from their Santa Monica home, on a hill overlooking the Pacific.

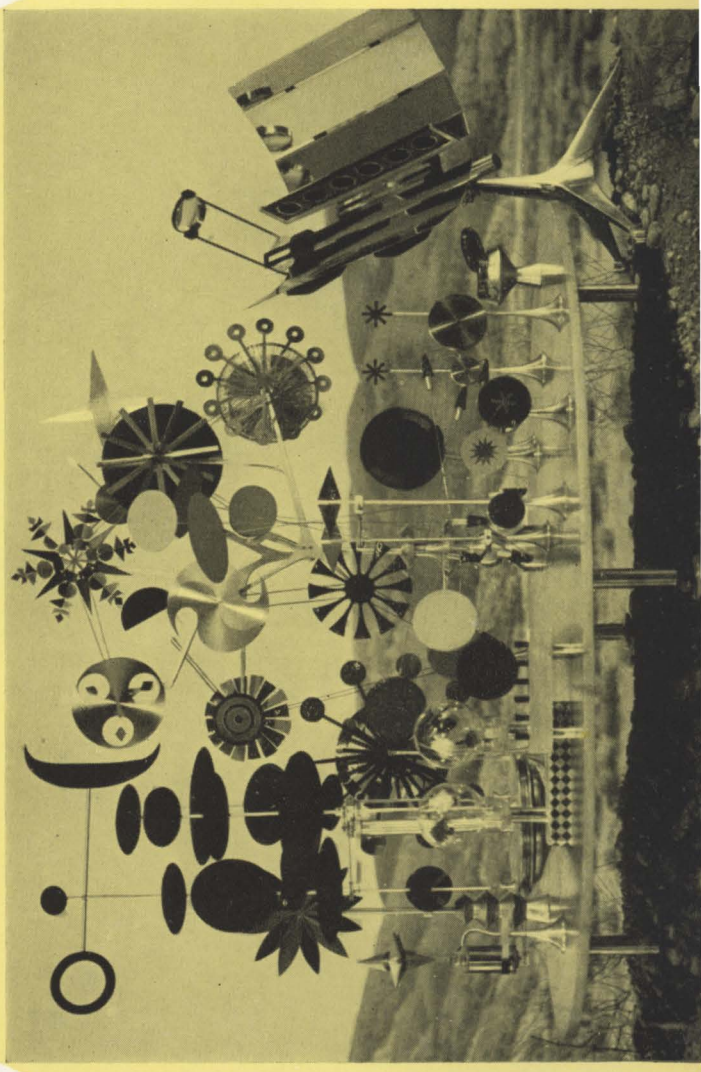
Charles Eames' recent contribution to Alcoa's FORECAST Collection is a moving sculpture—a toy powered by sunlight alone. A collector tracks the sun across the horizon, motors respond, wheels turn, pistons rise and recede, colors flash and blend. With the solar toy, Eames has used man's original source of energy to delight the eye and to pique the imagination.

There was first the question of whether to take on the problem at all. Life, said Eames, is too full of real problems to permit introducing hypothetical ones. He began outlining what an ideal hypothetical (or promotional) problem would be. He spoke of something that would have to do with natural resources. He spoke of a means for teaching the younger generation. As he concluded, he found that he had given an outline for a design problem. He agreed to carry it to conclusion.

One thing would have to be understood: if it were done, it would have to be at the highest level.

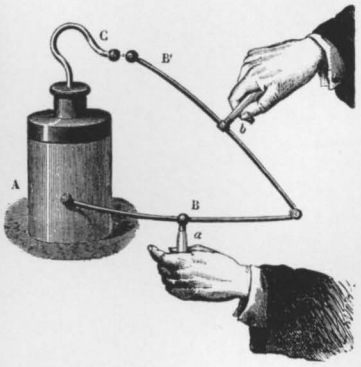
"This is tough," he says. "To make it tougher, we decided to do it within the idiom of the material and the device. We would try to achieve something elegant." A pause. "What we now have, I think, is not the most unelegant thing in the world."

To make a device that has no productive function requires an unremitting discipline. There is the temptation to harness the new and general to the old and specific. It could have been designed so that it would propel a conventional train about a conventional track. The instant that was done, though, the



PHOTOGRAPH BY CHARLES EAMES

CULVER SERVICE



Toys first, man's servants later: Far left, the Cartesian Devil, or "bottle imp"; devised by French philosopher René Descartes to demonstrate effect of changes in atmospheric pressure. Left, Leyden Jar; device for storing quantities of static electricity, discovered accidentally in 1745 by a professor at the University of Leyden.

device would have become something altogether different. It would have stopped being a big, broad idea and would have become a limited, narrow application.

"And so we decide to make a device that will do nothing. But the answer is not as simple as that. What *kind* of a nothing? You can do nothing in a baroque way. You can do it in a Gothic way. If you are not careful, you will wind up with a kind of hodge-podge nothing, a big splatter of schmaltz. (I have no objection to schmaltz per se, so long as it is not derivative schmaltz.)"

This was Eames speaking.

What kind of a nothing? The hope is that the solar toy, because it makes reference to a basic fact —and because it does not trumpet its significance— may be described as a transcendental nothing. Timeless. Unclassified. Unbracketable.

In a sense, what the sculptor makes is a do-nothing machine. It is not valid unless it is anticipatory in nature. The same is true for the painter.

A basic concern of the toy is the matter of connections. This is the problem in architecture. (And this is what, in architecture, most harasses modern man.) The branch of a tree somehow holds together. One end is supported at the trunk, only one end, and yet the rest of it, in spite of gravity, wind and small birds, is held, by some marvelous affinity of the molecules, out in space. Now let us saw off a section of the branch. We have destroyed a continuity. We cannot restore it merely by touching the severed ends together. And that is where we come to the problem of connection. Nature does not provide things in the forms of acceptable houses and tables and chairs, and so we are forced into becoming architects and designers, to make the reductions, rearrangements and connections that nature neglected to make for us.

Before we start, we think about all the ways of using and connecting aluminum. We think about it in terms of its reflectivity, its ability to conduct light and heat, its portability. When we understand these things so that we no longer have to think about them, then we are working from strength; we have achieved control, and there is no limit to what we are able to accomplish.

As Eames sees it, the metal should be visible; it should be delightful; its properties should be inherent to the use. He thinks of the toy as having three elements: the collector, the static device, and the device in motion. This, he says, one may call sculpture, but it is sculpture with the extra dimension of motion, (and, therefore, time).

There is little pertinence in asking what the toy is supposed to do. It is not supposed to do. It is supposed to be. Its whole function is in its being. Who ever asks what is the function of a sunset?

By being, the toy teaches something of the economy of natural resources. We open the door in an intriguing and fascinating way. It is a significant thing, the idea of directly using solar energy. The point is dissipated if we use the energy for some

immediate end, because then the emphasis is on the end, not the means.

"We now have a moment in time which is very precious," says Eames, "but this is valid only if the toy does nothing."

We say that we will do something in a manner that is not ordinary to the vocabulary of our times. It is what we look for in the greatest of poetry, an idea so universal that we have known it all our lives, expressed in such a lift of language that it is new. Good poetry does more than elicit agreement. It should startle us into thought. If it fails to do this, nothing has been gained.

Once a man or a child sees this toy, he will never go back in his thinking. When someone speaks of energy sources he should say, Yes, atomic energy is all very well, but what about solar energy? In fact, the vast energy of the sun is a more realizable concept than the vast energy of an atom. That most people have failed to realize the meaning of either concept may be due to the lack of a toy such as this to show it to them. Say what you will about it, the toy does demonstrate, in an immediate and unforgettable way, that the sun is more than a source of light and heat. The instant the motors start, unfueled, the idea becomes entirely clear. The viewer is immediately instructed. This was the objective: to demonstrate the availability of solar energy, and to do it in as delightful a way as possible.

Here is Eames speaking again:

"And this, I would say, would be a good test for any design. Does it make somebody aware of something that it is important for him to be aware of? And does it do it in a manner that is delightful (which is the opposite of pedantic)? In fact, this could be a good starting point for somebody wanting to make a design: to think first about what he wanted to make people aware of, and then to move toward the most effective and pleasing way of bringing this about."

Miracle ideas have frequently expressed themselves through toys; it is not a new thing that people should be made aware of physical principles by means of a toy. What were the Cartesian devil and the Leyden jar if they were not toys? By this is meant that they had the power to communicate an awareness—not necessarily a knowledge—of certain natural truths. It should be noted that these toys did not have a "function," in the sense of things that perform useful acts to pay their way.

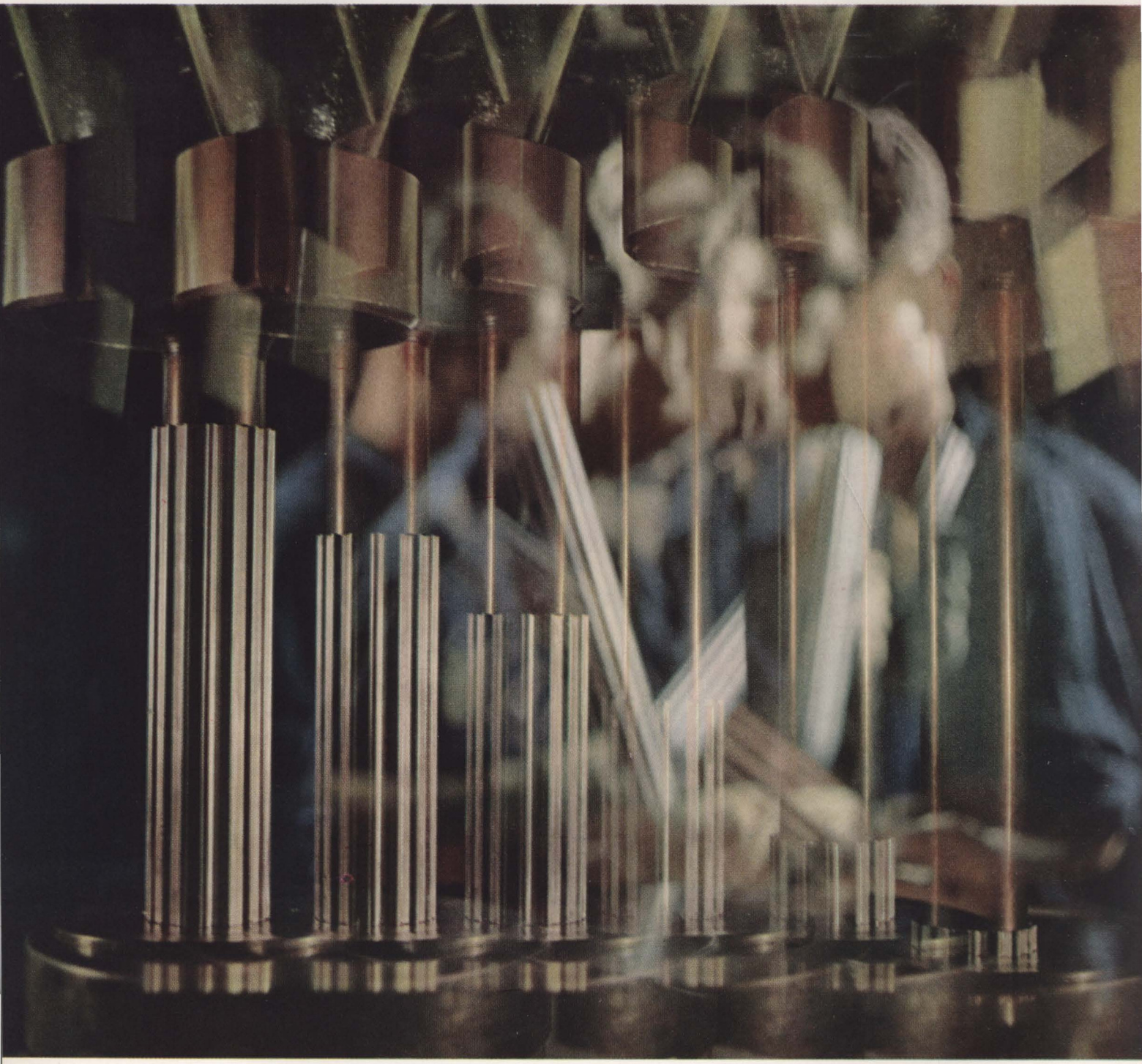
Some "toys" were used in miracle work, as when the high priest made the impenitents' hair stand on end by means of static electricity.

Missiles first appeared as toys. The same could be said for most weapons.

More than a century before Christ there was Hero of Alexandria, who had a vast understanding of hydraulics, pneumatics and mechanics. He made a bird that would sing by the action of a stream of water. He made a representation of two figures pouring oil on a fire, and he used the effect of heated air to produce motion in the figures. He created a hissing sound in a dragon by means of hydraulic action. (Note: no practical application. This comes later.)

One is tempted to ask what business the designer has coming first. Here is an answer. When Eames and his staff were working out the method of converting solar energy—they tried converting to steam first, but that proved too inefficient—they got in touch with the people at California Institute of Technology to see what they could learn. The thought was that Caltech would send over one man who could show them the most direct route. Instead the school sent five people to see what Eames had learned.

There are those who will look for the secret meaning behind the design. There is none. For those who cannot see it at the first level of consciousness, there is no sense in inspecting layer after layer. They are already past the point of focus.



Phantom stop-motion view of the birth and maturity of an impact. Total time lapse between start of process, right, and finished part, left, is a fraction of an eyewink: about 1/15 second. Intervals are 1/75 second.

A. R. VAN VORST
Manager, Impacts
Aluminum Company of America

Inspiration for the designer...

IMPACTS

Round, oval, square, or rectangular. Hollow or solid or both. Variable diameters. Internal or external ribs, bosses, splines or flutes. Cup-shaped shells or flanged or cupped-end tubes. Fantastically diverse combinations of these.

A description of the total fabricating output of a major full-line metal company? No, indeed. Merely a sampling of the potential of one technique—the impact process—perhaps the most versatile of all metalworking methods.

The significance for the designer is great. For the process is not only versatile in what it can produce. It is also versatile in the alloys that may be used. It imparts tough, forged strength to the product. It produces parts with extremely close tolerances. It leaves surfaces so smooth and true that later finishing operations are seldom necessary.

And it does this instantaneously, in one operation, cold, and at low cost in both limited and long runs.

The Beginning: Collapsible Tubes

Just after World War I, Alcoa imported some Swiss presses (and a Swiss engineer to supervise their operation), to begin the first U. S. production of aluminum toothpaste tubes. Tubes are made by what is now called the impact process: a small disc, or slug, of aluminum is seated in a die; a punch strikes the slug in the die; the metal flows into any available space—in this case, up around the punch, whose outer diameter is less than the inner diameter of the die—and keeps going in a straight line once it gets started, until it is deflected.

Alcoa's engineers were fascinated as they watched collapsible tubes grow up around the punch. They asked that greatest of all questions, "Why couldn't . . . ?" and found that indeed they

could. Could use bigger slugs, could create different contours, could use hard alloys.

Eventually the child turned on the parent and gobbled him up. Today, the impact process—originally an incidental offshoot of the collapsible tube process—is a major metal-working technique.

Starting point for all impacts is the slug, which may be blanked or punched from sheet, slab, or plate, sawed from rod, tube, or pipe, or itself an impact (generally in special cases such as where ultra-high strength and tolerance requirements must be met). The slug provides a closely-controlled volume of metal in a precise, predetermined shape. Seated in the die—fed either automatically or by hand—it is the reservoir of metal from which the finished impact flows.

Any Direction

Metalworking people describe impacts by the direction the metal flows in relation to the stroke of the punch. While this may be purely academic for the designer, a description of these types provides an exploration of one aspect of their potential:

Reverse. Most common method of impacting is the reverse process. The collapsible tube and a host of other impacts, such as electronic condenser cans, are made by metal flow back around the punch, in the reverse direction of the punch stroke. If there is an orifice in the punch, metal will also flow upwards into the punch, forming a double-walled part, called a "double reverse" impact.

Forward. With no room between the punch and die wall, and with apertures in the die, metal flows forward down into and through the die, in the same direction as the punch stroke. Typically, flanged tubes are made by forward impacting, with the flange formed in the die and the tube extruded through the die.

Combination. Provide carefully for metal to flow both up around the punch and down into the die, and you have a combination impact. Parts hollow on both ends, with a solid mid-section web, are the unique typical products of this method.

And now, even more . . .

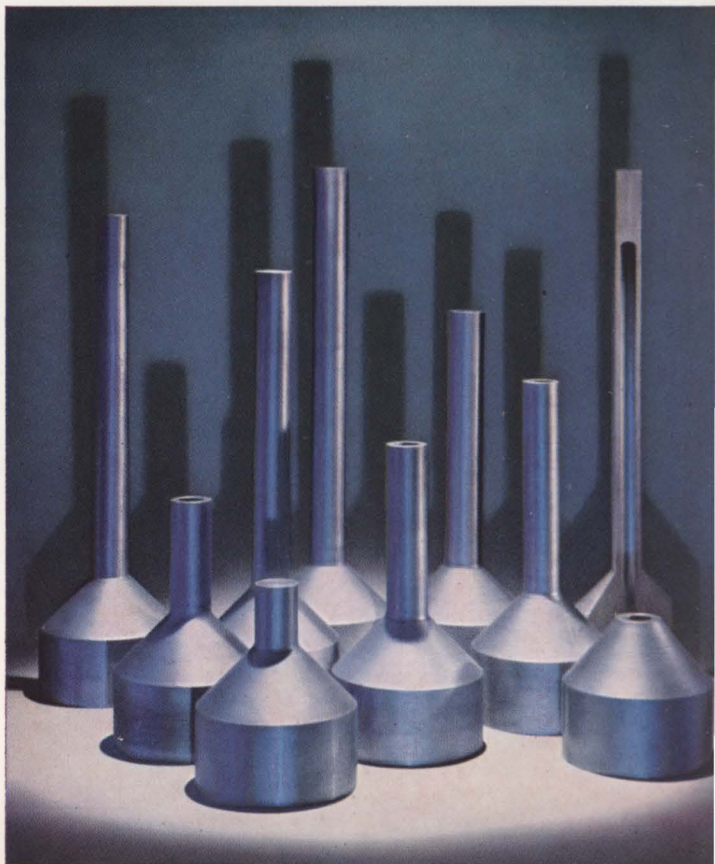
Lateral. Just announced this May by Alcoa is the commercial availability of a "new direction" in impacts. In this case, lateral metal flow, perpendicular to the direction of the punch stroke. Lateral features may be obtained in combination with any of the other impact types. No one has yet applied this potential to a product, but think faucet handle or steering wheel spider (hub and spokes), and you are thinking lateral impact.

Centaur-like

As the centaur combines unique features of man and horse, so the impact process combines unique features of extrusion and forging.

Extrusion imparts maximum strength and toughness. This process permits the production of long, close-tolerance sections that exceed infinitely the potential of drawing. Its use eliminates either economically unfeasible machining from solid stock, or higher-priced, less-strong, bulkier, joined assemblies. The portion of an impact that flows up, down, or out is an extrusion.

Forging permits fabrication of high-strength,



Eerie forest of forward impacts. Various lengths of tube and cutaway shown; full-size version is piece of "rocket hardware."

close-tolerance sections with complex, intricate detail. The portion of an impact that is worked and remains within the die is a forging.

Limitations (Today Only)

From a metalworking technical standpoint, the size of impacts is essentially unlimited. Naturally assuming that it is feasible with the process, all you need to make a given impact is a press with the capacity to do the job.

It is today's press equipment, therefore, that places size limits on impacts. Disregarding lateral impacts for the moment—even Alcoa is as yet not fully aware of the potential of this technique with today's presses—the approximate limits are:

Maximum diameter of part:	12 inches
Maximum length of part:	60 inches
Maximum wall thickness:	12 inches
Minimum diameter of part:	.250 inch or less
Minimum length of part:	no effective limit
Minimum wall thickness:	.010 inch
Minimum closed-end thickness:	.020 inch

The indicated upper limits, by the way, became possible only this year, with Alcoa's installation of a 2500-ton press that upped diameter limits by 100 per cent, and possible length over three times.

It should be borne in mind that technical considerations would make it impossible to incorporate all the upper and lower dimensional limits into a single given part. In addition, the working properties of the harder alloys would in some cases modify certain limits, generally the lower limits.

There are two "escape valves" on impact size limits. The first of these is that engineering ingenuity has in the past been able to squeeze out a little more length or diameter or thickness than theoretical capacity; a product is therefore impossible only after the engineers have determined that they can't squeeze enough for its particular requirements. Secondly, the press equipment will be bought if the market potential is there: Alcoa's 2500-ton press was installed simply because of an apparent potential market—if designers and manufacturers come up with an array of possible impact parts needing two, three, or ten times the capacity, the equipment can be made available.

Tolerances

Impact tolerances are not truly limitations, but more properly—because of their closeness—positive advantages. Ranging in respect to size of the part and the choice of alloy, tolerances are:

Wall thickness:	± .003 to ± .015 inch
Wall diameter:	± .005 to ± .015 inch
Cross section, outside:	± .008 inch
Cross section, inside:	± .010 inch

Basic Considerations for the Designer

The features possible with impacts that are of particular concern to the designer include:

Contours. An impact cross section may be round, oval, square, rectangular, polygonal, or a complex of straight and curved sides. While symmetry is desirable, it is not necessarily mandatory, and is of minimum concern with parts of relatively shallow depth.

Ribs. Longitudinal ribs (or flutes, or splines, or whatever the name) may be incorporated inside or outside impacts, extending the full length. On combination impacts, ribs may be designed into one or both sections. They have been designed to run across the bottom of some closed-end parts. They may be designed as full-length interior vertical partitions. Symmetry is important with deep ribs, but may be disregarded when pattern depth is shallow.

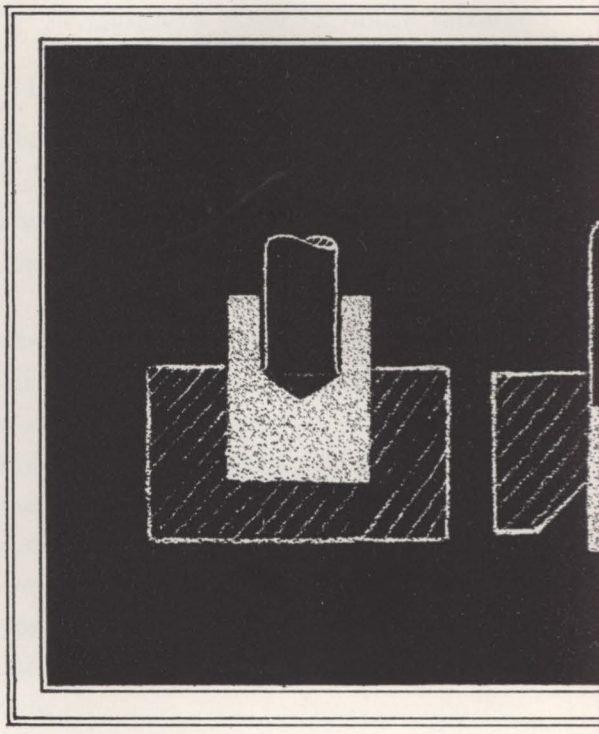
Multiple Wall Sections. Impacts may be designed with integral center tubes that are long or short; hollow or solid; round, oval, square, or rectangular; with either end open or closed; and in practically any diameter within the outer shell.

Flanges. Either open or closed, flanges may be located on one end or, with the combination impact, at an intermediate point. They may be flat, tapered, or stepped, and of any thickness. (The combination of light-wall tube with heavy flange is economically possible only with the impact.)

Ends and Webs. Ends (or webs, in the case of combination impacts) may have any desired con-

tour or thickness. Possible only with impacts are such features as rounded ends, sections angled to walls from a recessed center, areas substantially thicker than the sidewalls. An immense range of extensions on ends is possible. On either side of the end or web, the designer may incorporate such extensions as bosses, lugs, tubular projections, grooves, depressions, or recessed cavities.

Surface Finish. Inherent in the impact design are such surface finish qualities as smoothness, brightness, lack of parting line, absence of seam. The designer may frequently design with impacts so that all intermediate finishing operations are eliminated, with a part going directly from the forming operation to a final finishing step, such as anodizing.



Today's Major Applications

A substantial portion of the impacts produced today fall into certain general product classifications, which together are suggestive of types of use for which the product is well suited.

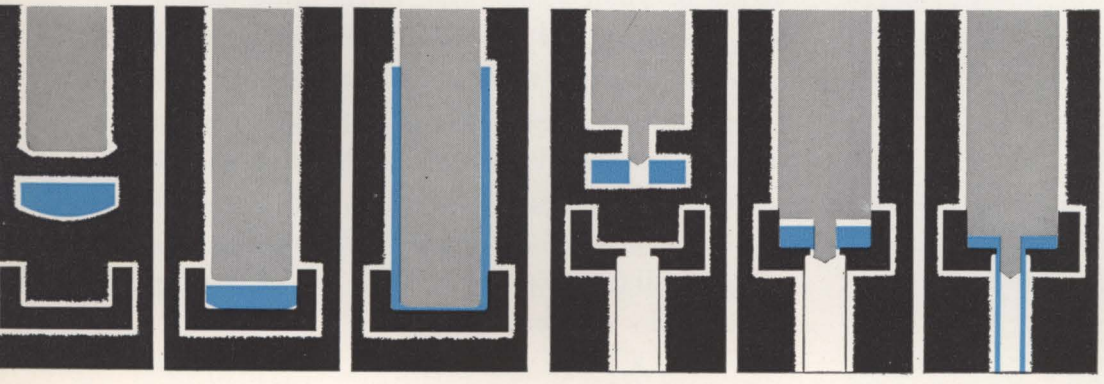
Vacuum Bottle Cases. Impacts are the most economical one-piece, seamless shell of the size and proportion required for this use.

Flashlight Cases. Lower in cost than seamless shells produced by other methods, impacts allow integral design of ribs, flutes, and sunbursts. During extrusion, the open end may be expanded to accept the reflector.

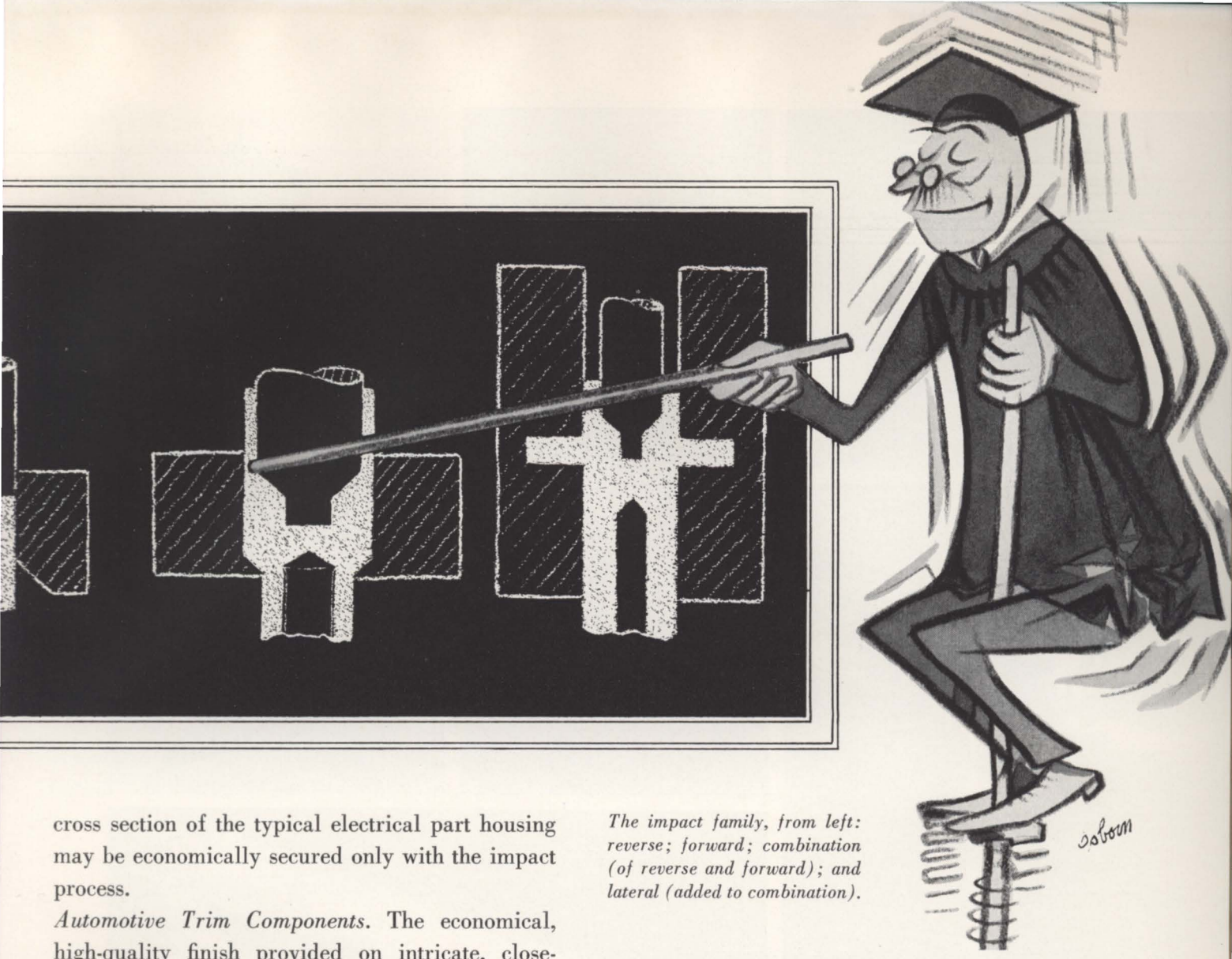
Door Check Cylinders. As opposed to an assembly of steel tube joined to an end plug, impacts are of one-piece construction, offer distinctive styling possibilities with ribs, and require neither finishing operations nor protective coatings. Other similar uses are grease gun cylinders and fountain stencil brush reservoir handles.

Oil Filter Cans. This use typifies the ability of the impact to provide economy in high output production of relatively simple can-shaped parts.

Electric Device Housing. The complex functional



Stylized view of the two fundamental impact techniques. Left three sketches show: (1) punch, slug, and die; (2) moment of impact; (3) "full-grown" simple reverse-impacted closed-end shell. Right three sketches: (1) punch, hollow slug, and die; (2) moment of impact (note punch projection through slug); (3) completed simple forward-impacted flanged tube.



The impact family, from left: reverse; forward; combination (of reverse and forward); and lateral (added to combination).

cross section of the typical electrical part housing may be economically secured only with the impact process.

Automotive Trim Components. The economical, high-quality finish provided on intricate, close-tolerance impact parts is typified by impacts used for such automotive trim components as front grille elements, taillight assemblies, and interior decorative hardware.

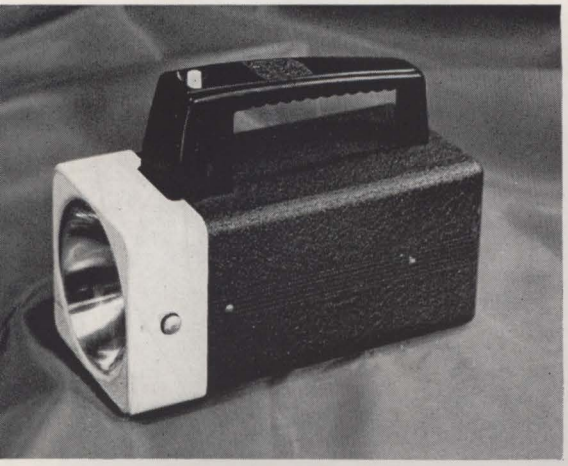
Pressure Vessels. Impacts are economical and reliable as housings and cylinders for pressure-tight operations. Their high strength and seamless construction combine with the ability of the designer to incorporate bosses and tubular extensions that can receive fittings, and eliminate a welded or brazed assembly. Threading or tapping operations are made possible by the designer's ability to incorporate increased section thickness in various areas.

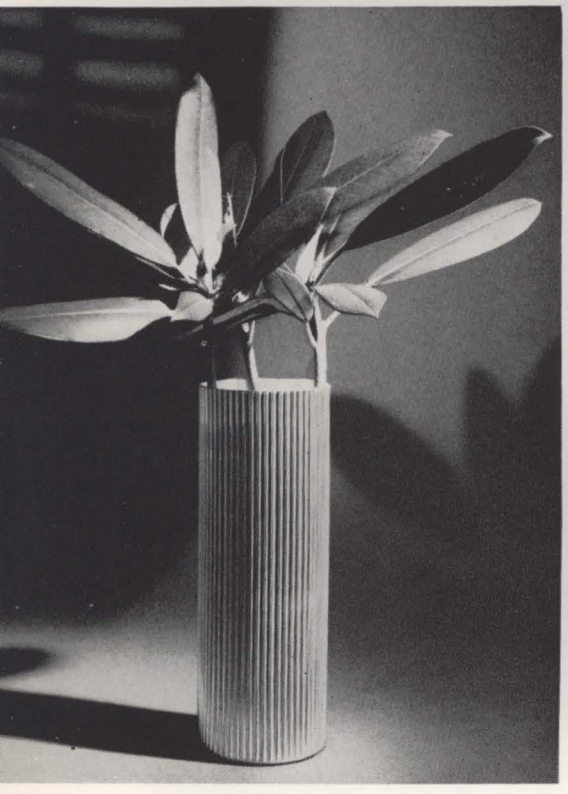
Appliance Components. In applications such as percolator bodies and components for vacuum cleaners, refrigerators and air conditioners, the

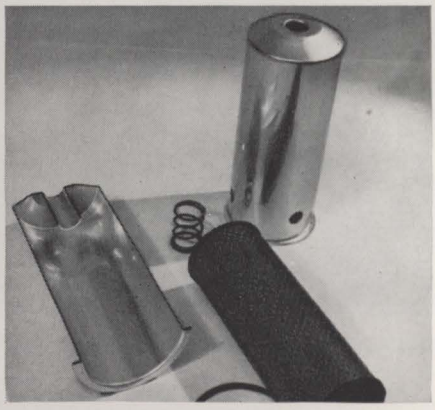
FLEXIBILITY OF IMPACTS

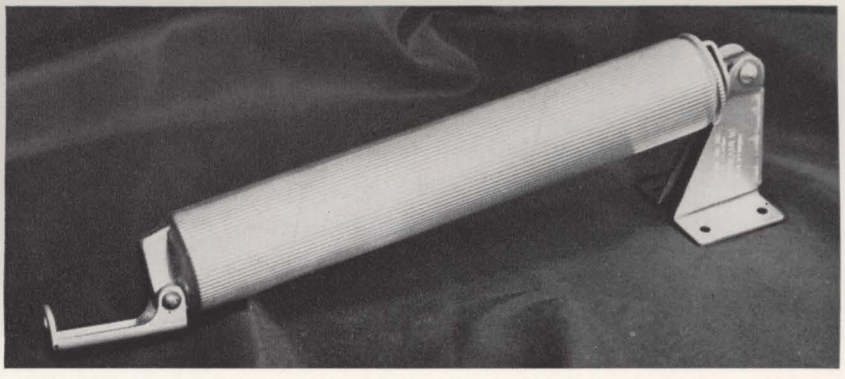
A Check List of Design Objectives Attainable with Impacts

1. Minimize the amount of metal in parts.
2. Obtain complete wrought properties.
3. Save substantially on machining costs.
4. Obtain top properties of heat-treatable alloys.
5. Obtain straight, draft-free walls.
6. Use thin sections.
7. Obtain dense, porosity-free, metal structure.
8. Obtain parts with unusual cross-sectional shapes.
9. Combine multiple parts in a one-piece design.
10. Obtain deep, closed-end shells economically.
11. Obtain parts with a smooth, seamless surface.
12. Incorporate ribs or fins on sidewalls.
13. Design tubular parts with flange on end.
14. Design parts with forged detail on end.
15. Obtain parts with bottom thicker than sidewall.

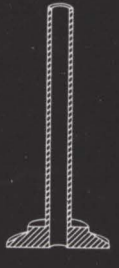








Typical impact uses, clockwise from directly above: decoratively ribbed vase; rectangular lantern case; high-pressure case for siphon; intricately formed pressure case for gasoline torch; oil filter case; last, a ribbed door check housing.



Flanged tubular parts are produced to extremely close tolerances, requiring a minimum of machining, for use as machine components.

This impact design features soundness, high strength and light weight.

Inside ribs can be stopped off near the closed end as shown.

impact provides maximum metal usage and minimum secondary and finishing operation requirements, thus providing the desired quality of part at lowest cost.

Of minor concern to the industrial designer as such, but of major significance in terms of impact applications, are the many uses for this process both as so-called machining blanks, and as components for military and atomic energy equipment. In the first case, the impact is an intermediate part, supplanting a massive and simple form such as a piece of rod, with a strong, sophisticated form that is later machined. (The high cost and high scrap generation of machining are both minimized with this use of impacts.) In military-atomic energy uses, the impact is chosen for such features as high strength, close tolerances, and lightness.

ONLY WITH IMPACTS

Design Features Economically and Practically Obtainable Only with Impacts

1. **Cross sections uneconomical or impractical to fabricate by the draw process.**
2. **Deep sections with lengths eight to ten times diameter, or more.**
3. **Closed end thicker than wall.**
4. **Closed end with forged detail.**
5. **Decorative or functional sidewall ribs.**
6. **Stepped sidewall, changing wall thickness.**
7. **One-piece design combining multiple parts.**
8. **Flange at end of tubular part.**
9. **Superior strength required.**
10. **Draft-free close tolerances necessary to reduce machining.**
11. **Smooth, seamless parts requiring little or no finishing operations, to be used without protective coatings.**
12. **Light, complex part requiring pressure-resisting strength.**

Where To?

Alcoa's engineers are working toward the impact of tomorrow. They expect greatly increased size and further sophistication of the form to characterize the future impact. Among anticipated developments are . . .

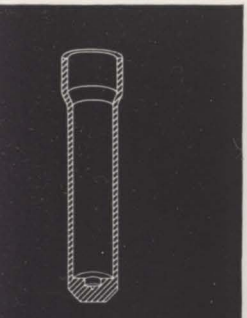
. . . continued tooling innovation as characterized by the lateral impact development.

. . . shell-like designs with diameters many times today's maximums, in the three-to-four-feet-and-greater range.

. . . tube-type parts with greater diameters: six-to-eight feet, or even larger.

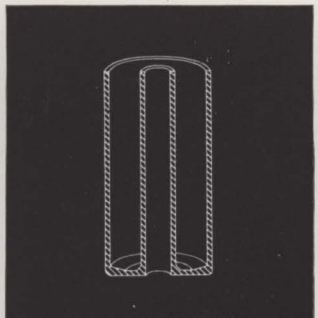
. . . integrated facilities for regular production of components such as domestic water heater tanks, oil drums, large distribution transformer cases, and washing machine tubs—in each case made typically in one operation, seamless, incorporating complex decorative and functional design features.

The designer is not confined to this glimpse of tomorrow for his inspiration from impacts. Many broad product categories have been untouched, or virtually so, by today's impact and its potential. A

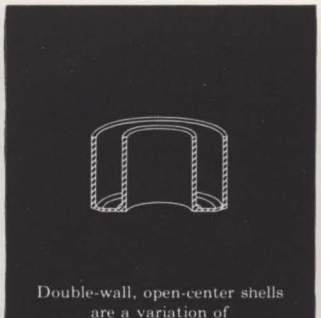


This is an expanded open-end shell showing an inside cavity a heavy closed-end section.

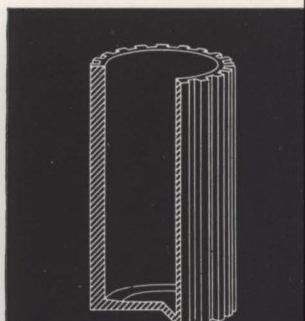
Impacts are extruded with design features that might otherwise require broaching or milling operations. The splined cavity shown is an example.



Manufacturing problems are simplified and costs reduced through the use of extruded shells with integral center tubes.



Double-wall, open-center shells are a variation of the center-tube design.



Outside longitudinal ribs, decorative and often functional, can be spaced equally or grouped in symmetrical patterns.

IN SUMMARY—*Design Factor Review*

1. **The forged section may be the closed end of an impact, or the flange of a tubular part, or the web between multiple extruded sections.**
2. **The forged section may be flat and smooth, or it may have typical forged design detail on either or both sides.**
3. **The extruded section may be round, square, or a complex cross-sectional shape.**
4. **The extruded section may have longitudinal ribs inside or outside.**
5. **The extruded section may be stepped inside or outside, to change section thickness.**

sampling of such fields would include . . .

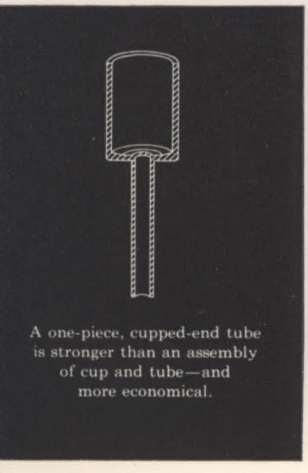
. . . builder's hardware
. . . decorative aerosol containers
. . . unit packages of high-pressure fluids
. . . business and data processing machines
. . . highway architectural hardware
. . . giftware
. . . commercial and decorative furniture
. . . fire extinguishers
. . . toys
. . . hand and power tools

And many more.

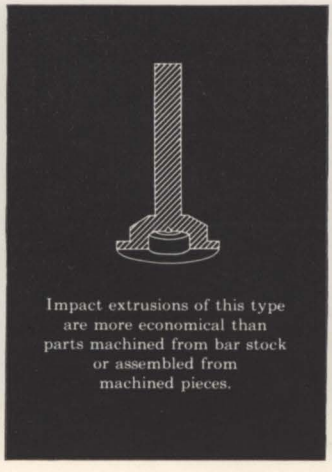
The particular features and advantages of the impact—with its inherent economy at the forefront—make this process a "must" for consideration by the designer. It is a process whose potential has scarcely been probed.

GEORGE WEISNER

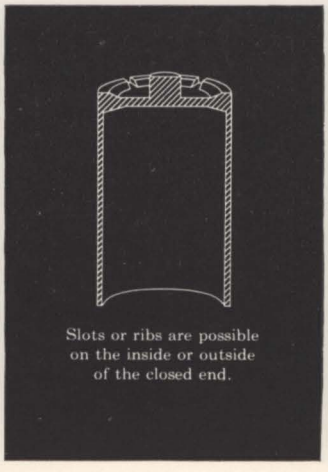
Extremes of the impacter's art, from an over-all size viewpoint. Hand, holding typical small impact shell, is dwarfed by the goliath of impacts, largest made to date: cylinder 8½ in. diameter and 34 in. long. Potential of today's largest press: up to 12 in. diameter; up to 60 in. length.



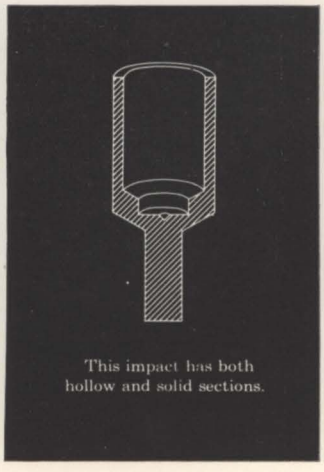
A one-piece, cupped-end tube is stronger than an assembly of cup and tube—and more economical.



Impact extrusions of this type are more economical than parts machined from bar stock or assembled from machined pieces.



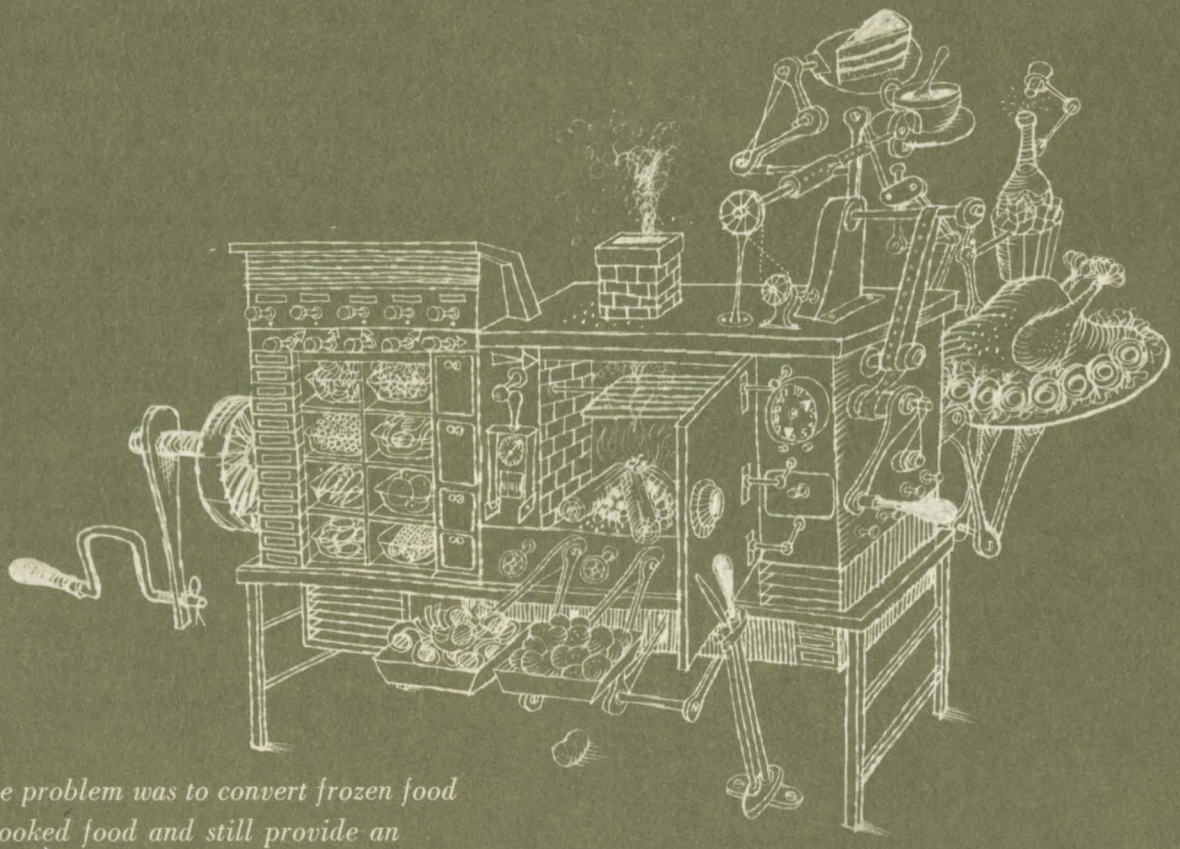
Slots or ribs are possible on the inside or outside of the closed end.



This impact has both hollow and solid sections.

APPLIANCES FOR TOMORROW— THE MANUFACTURER'S CHALLENGE

C. K. RIEGER
Vice President and General Manager
Major Appliance Division
General Electric Company



"The problem was to convert frozen food to cooked food and still provide an outlet for creative cooking . . ."

Anyone in the appliance business who dreams about the challenging years ahead must keep one point firmly in mind: the manufacturer who succeeds will be the one who makes things people want. This sounds deceptively simple. Unfortunately, it's a difficult task.

Producing something new and different is never easy. Making something new and different that other designers and businessmen will consider worthwhile is even harder. But designing it and manufacturing it so that the public will recognize it as something of value is most difficult of all.

It is so difficult, mainly, because people do not know what they prefer until they are presented with some nice, solid, three-dimensional choices. Then they can buy one, and let the company that makes the other go out of business . . . or, at least, offer a more desirable product.

The industrial designer who elects to help an appliance manufacturer solve this problem must lead in the particular art of anticipating what people will want even before they know that they will want it.

This is a difficult job. But it can be done; it has been done by our company and by others. This, fortunately, gives us some guideposts. It is certain that the designer must exercise the creative imagination which sets him apart from being a mere modifier of what the competition offers. He must exercise it in cooperation with scientists who can keep him abreast of materials and processes that are about to become available. He must exercise it in cooperation with economists who can predict income and spending trends, and with sociologists who can suggest the directions of family growth and activity, and population shifts. Further, and this is most important, he must exercise it in the interest of those who will use the appliance he designs.

"Here was a case in which designers, engineers, product planners and others cooperated . . ."

Certainly it has been true in the case of our own Division that we have been most successful when we have made things more convenient and easier to use, easier to clean, easier to understand, as well as better looking. Examples are such developments as revolving and swing-out refrigerator shelves, removable oven doors, raised "no-drip" edges on range tops, a mobile dishwasher that needs no installation, clothes washers that filter out lint, washers that have controls which automatically give the housewife the right washing and rinsing and spin-dry conditions for a particular load.

Some of these, as you will note, have been developments of existing products. Occasionally, as in the case of the mobile dishwasher or the food waste disposer, a whole new product has been needed. What all these examples have in common is that they contributed not just a styling change, not just something a designer himself liked, but something which helped solve a problem in the home.

At its best, problem-solving design also results in a more pleasing appearance, both for the appliance under consideration and the environment in which it fits. As an example, I think of our refrigerator with no coils on the back and with a door which swings within the cabinet width. Here was a case in which designers, engineers, product planners and others cooperated to produce a refrigerator which took up less space, offered greatly increased flexibility of location, adapted easily to a "built-in" appearance, and presented an extremely clean, modern, functional look, either by itself or in its place in the kitchen.

And let no one tell you that fitting into its environment is not an important consideration for an appliance. If there is one thing about our world on which everyone can agree, it is simply that life at all levels

"She is chauffeur, cook, handyman, nurse, social worker—frequently several things at once."

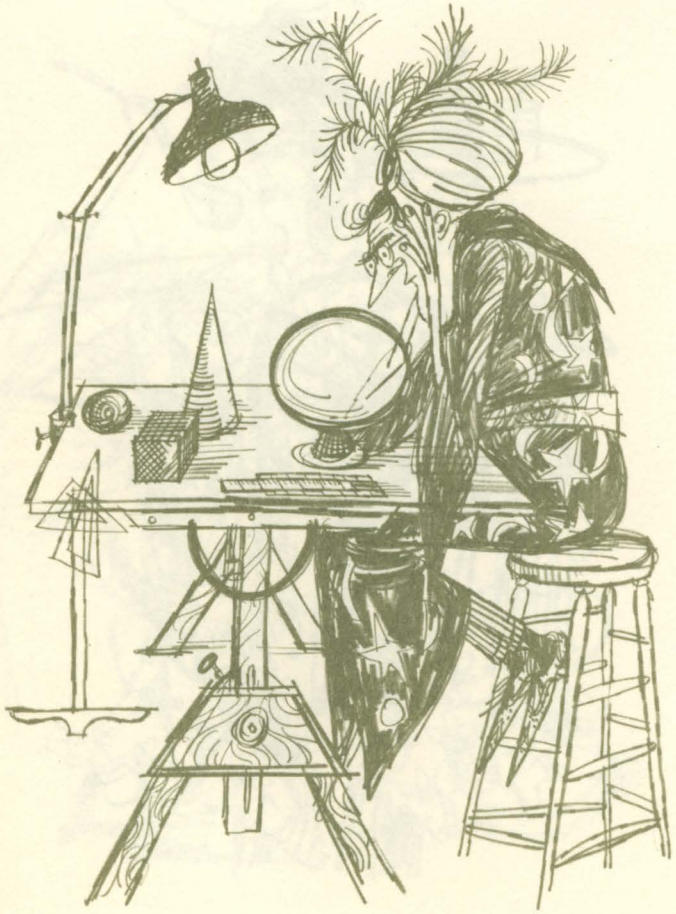
is getting more and more complicated. Home life, during waking hours, is hardly ever peaceful for very long, and the life of a housewife is an unceasing round of obligations, meals, caring for children's needs, helping in civic affairs, and on and on. She is chauffeur, cook, handyman, nurse, social worker—frequently several things at once. Nor does it appear that her problem will lessen in the future.

In this situation, the major appliance manufacturer can make an important contribution; he can offer a kitchen-laundry area that is complete, functional, easy to use and emotionally satisfying. It can be, if you will, a refuge from the unorganized, sometimes frustrating, activity that apparently is a necessary corollary to the growth of our world.

To our way of thinking, it is no small matter if a woman can step into her kitchen and say to herself: "Here, at least, everything is right and helpful." There is an emotional satisfaction that depends on proper functioning of all the appliances, but, which transcends it. The major appliance designer who can help provide such satisfaction will be doing a good job; appliance manufacturers will seek him out.

To do the job, the appliance designer will have to weigh trends toward fragmentation of device and house, on the one hand, against trends toward centralization of both, on the other. He will have to be conscious of new materials and their total costs, including the cost of fabrication and their serviceability. He will have to be conscious of the logical development of known technologies because, in most cases, that is the best way of making sound progress. But, mostly, he will have to be conscious of problems of living—as they are now and as they will develop—so that he can offer solutions that, added up, mean a more satisfying life for the user.

In the actual work of designing, it probably will



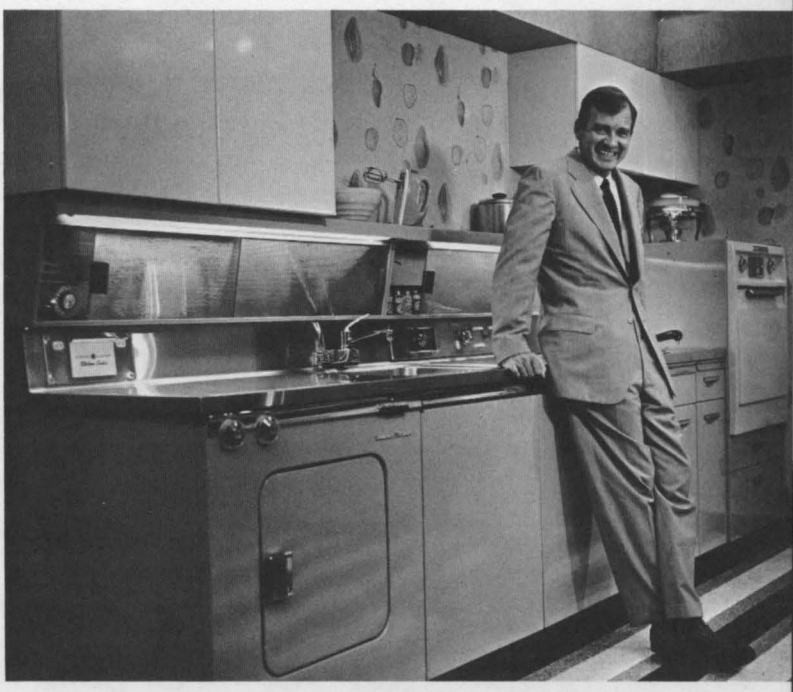
". . . he will have to be conscious of problems of living—now and as they will develop . . ."

help the designer if he breaks the problems into two groups—physical and emotional—and tests out his brain-child against two sets of criteria. Will this new device be more convenient to load? Will it be easier to clean? Will it be easier to service? Will it be financially feasible but of better quality? Is it generally more practical? At the same time, he must consider whether it leaves a woman free to do those creative tasks which she wants to do and which keep her role from becoming that of a mere button-pusher. No woman wants to do a dirty job that a machine can do for her. But, at the same time, she wants no machine to rob her of those opportunities she has where she may shine. Occasionally, she may not feel like cooking for a gourmet, true. At such times the ultimate in automation may well be the answer. But when she does feel like turning out a masterpiece, her kitchen had better provide the means whereby she can have personal control of the project. The designer must be responsible.

The major appliance manufacturer who produces goods which will satisfy these physical and emotional needs is the one who will continue in business successfully. The appliance designer must help analyze these needs, anticipating them by several years, and express the answer in solid, three-dimensional forms.

To the extent that he does the entire job, the appliance designer goes far beyond the role of a person who "pretties up" what someone else has conceived. He becomes instead a full-fledged partner in the vital process of creating new products to contribute to people's wants and needs.

Practiced in this way industrial design becomes a resource of management to insure the company's future growth. The challenge to the designer is to live up to the full possibilities of his function.



Charles K. Rieger joined General Electric Company in 1936 as a student engineer. After holding a diverse number of sales, engineering, and managerial positions with various G. E. divisions, he was elected a vice president of G. E. in early 1953, and appointed general manager of the major appliance and television receiver division later that year.

APPLIANCES FOR TOMORROW—
THE DESIGNER'S ANSWER

ARTHUR N. BECVAR
Manager, Industrial Design Operation
Major Appliance Division
General Electric Company

"But designing it and manufacturing it so that the public will recognize it as something of value is most difficult of all."

How does the industrial designer respond to the challenge of doing the job management expects? Of course, he must be able to *draw;* but his real need is to be able to *think*—and in such a way that he contributes to the company's growth.

One of the ways in which he can do this is to serve primarily as an *innovator* and *catalyst.* His job is putting things together in a "creative manner." With the ideas of laboratory research people, engineers, and marketing people and by analyzing customers' wants and needs, the industrial designer can put together product options for management. Since the design of most products today is a complex system of materials, processes, and engineering principles, the designer cannot work in isolation. He must help visualize and demonstrate in an attractive and useful manner these possibilities for business growth.

Management must have and utilize the resources it has for *innovation.* The most prominent resources are scientific laboratories and engineering skill. Broadly speaking, there are two types of innovation: one is scientific invention or the development of new technology; the second is the rearrangement of known principles and processes.

Industrial design can contribute in both these areas in a special way. The industrial designer can visualize and put in concrete form an idea of how new technology could shape a new product and contribute a service for possible future ways of life. This representation—though it may be far from the achievable mark—can serve as a stimulus inspiring laboratory scientists and engineers to focus on the new way of looking at the problem. It should actually help them by awakening their ideas as to possibilities in the same or new directions. For example, miniature transistor portable television was visualized by the industrial designer to be the size of a camera to serve for boating and other outdoor uses. This designers' idea served as a stimulant to the engineers' experiments with small transistor television sets.

The second, and more frequent, contribution is in the rearrangement of known principles and processes. This the designer does when he studies the

"This designer's idea served as a stimulant to the engineers' experiments with small transistor television sets."

"*Design, in its initial planning stage,* is thinking *about* problems . . ."

human use of things and improves their relationship both physically and emotionally. An example of this was the design of the refrigerator with the fresh food portion at the top and the frozen food in a drawer at the lower part of the box. This arrangement better served the user by putting the more frequently used fresh food at the top and the less frequently used frozen food below.

Often the designer's target is not obtainable, but its by-products are valuable! To illustrate: while working with refrigeration engineers and scientists on a new vacuum-type insulation, the industrial designer was searching for a new form by which to capitalize on the advantages of this insulation. Early experimental studies were of a thin-wall vacuum-type insulation for a wall refrigerator. The insulation as originally planned did not materialize, but the wall refrigerator did result—but with standard insulation.

Another way the designer in industry can contribute is to look at the human being as part of a *system* of accomplishing a task. This *systems thinking* offers new possibilities. Electronic computers, data processing equipment used for memory storage of information, automatically timed transfer devices—such as conveyors developed for factories —and selector mechanisms; all pointed the way in an experiment which led to the building of the XPC, the experimental programming cooker.

The problem was to convert frozen food to cooked food and still provide an outlet for creative cooking and offer the convenience of package meals. Our own experiments—plus technology already recognized—resulted in the XPC machine, which combined a freezer with an electronic oven by way of a conveyor belt system. Meals are selected by a button, transferred from the freezer to the electronic oven, cooked the right length of time, and moved out of the oven when ready to be served.

Design, in its initial planning stage, is the *thinking* about *problems*—not their solutions. By this I mean: finding out if the problem has been clearly stated and is understandable to the people concerned; seeking planning concepts by learning the

aims, methods, and processes; establishing large concepts rather than immediate aims; talking to engineers, scientists, and sociologists to find out what people may want and need for their future living patterns; and finally, synthesizing and visualizing them in an attractive and distinctive manner.

These are the things that go on in a designer's mind before he sets pencil to paper. They make the difference between *styling* a product and exercising *creative imagination.* They set him apart from the mere modifier of competition.

This process of thinking about problems enables the designer to make a contribution to his company's growth by producing a meaningful and more useful product design.

There are four spheres in which the industrial designer could and should operate: *appearance design* (or styling, as it is sometimes called), *product image* (or visual value), *convenience of use,* and *innovation.*

In all these areas the designer can contribute to specific customer and management needs. As examples:

Appearance design (or styling) is aimed at point-of-sale impact in relation to competition.

Product image or visual value is a synthesis of what the company stands for and believes it is, and how the customer views the company.

Convenience of use requires an analysis and a creative solution by the designer to satisfy the needs of the customer or user from the standpoint of safety, legibility, understandability, cleanability, and accessibility.

Innovation is the designer's contribution to the creative visualization of new technology or the improvement of existing technology.

By his training and natural aptitude, the designer is equipped to operate in the aesthetic sphere.

In terms of product image, however, the designer must become a part of management by understanding its aims and objectives. He must familiarize himself with the customers who will buy his product, through research; and he must then integrate their needs into the visual value of the product. Form and materials, and the way these are combined, are very meaningful to the product image.

Arthur N. BecVar has been with the General Electric Company design group since 1945, and since 1948 has been manager of industrial design for G. E.'s major appliance and television receiver division. Among his many professional honors and activities: former president and board chairman, now fellow and director, A.S.I.D.; fellow, Design Directors in Industry; board member of the Building Research Council; principal speaker at 1951 World Congress of Industrial Design.

The designer must have a broad understanding of human engineering and a knowledge of sociology, so that he can discover what is happening to people, and determine how he can design for their convenience, wants, and needs of the future.

In innovation, the designer's creative role in visualizing new product opportunities for the future can be a vital resource of management.

In all these areas, the designer does not work in isolation but as an integral part of the total business process—trying to make his work effective. Of course, he must be able to communicate his ideas proficiently—both visually and verbally.

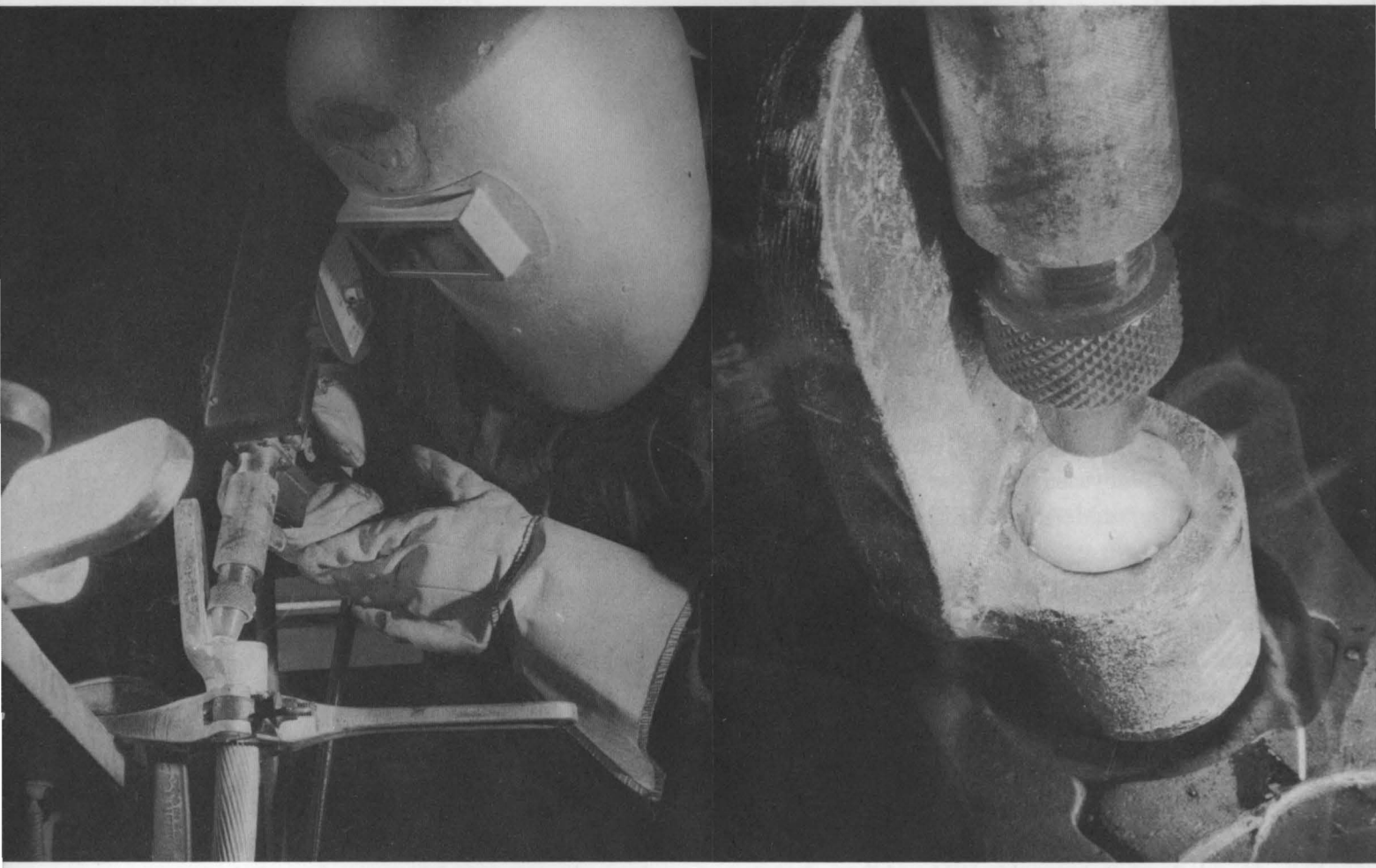
It is an interesting challenge, one that makes an individual grow when he accepts it. It is likewise one that, when accepted by enough real designers, can make industrial design grow into the more fully contributing function management seeks and needs.

The camera's eye... JOINING

There's considerable drama and visual poetry in the joiner's art. Some of this has been caught by the camera and is presented on these pages.

There's also a certain point to this: despite contrary tradition, and old wives' tales notwithstanding, aluminum is both easy to join, and susceptible to the total range of joining procedures.

Here are ways industry is effectively and economically joining aluminum: *Adhesives; Brazing* —torch, furnace, dip; *Mechanical*—bolts, metal screws, self-threading, couplings, fastener assemblies; *Riveting; Soldering; Welding*—such types as inert gas, spot, flash, arc, stud, cold, ultrasonic.

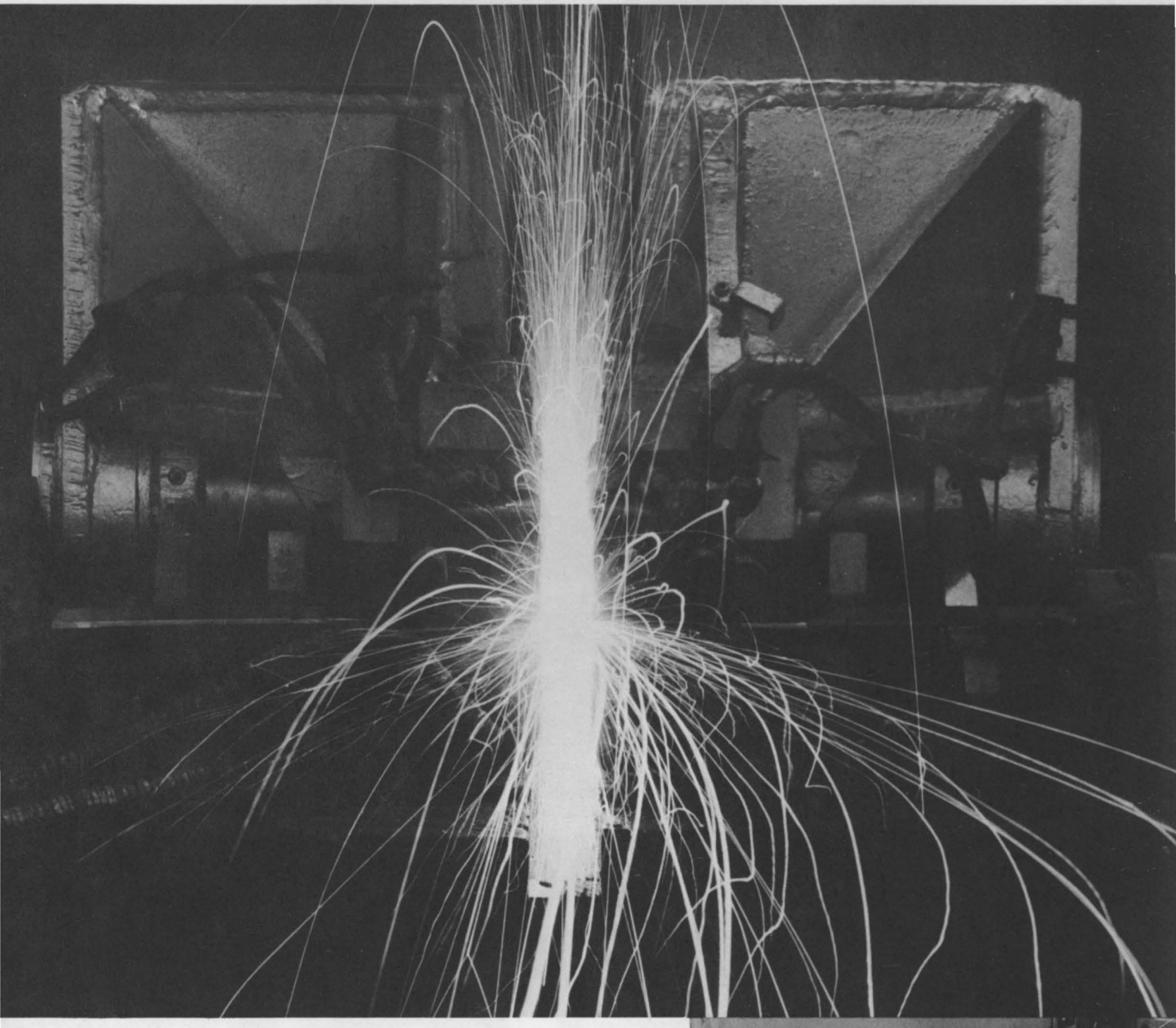


CONSUMABLE ELECTRODE WELDING *(more formally, "inert gas shielded metal arc welding with consumable electrode"), provides an other-planet appearance. Detail at right shows actual weld area; operation is joining a terminal to the end of an aluminum electrical power cable.*

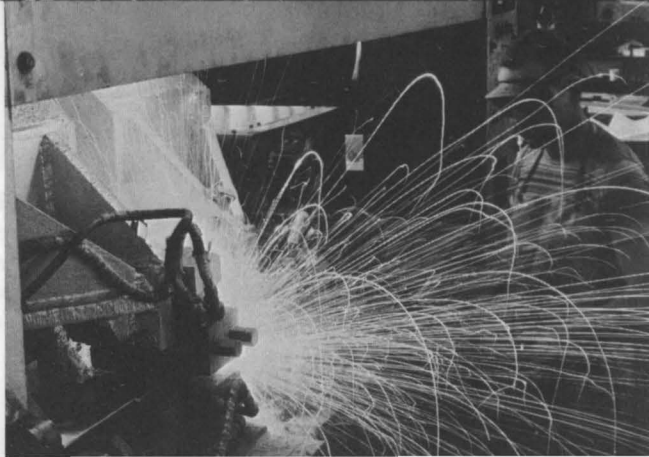
MAN-MADE HONEYCOMB *is being fabricated by oxyhydrogen torch welding. The entire assembly, a ten-foot octagon, is used to produce parallel air flow in a wind tunnel.*

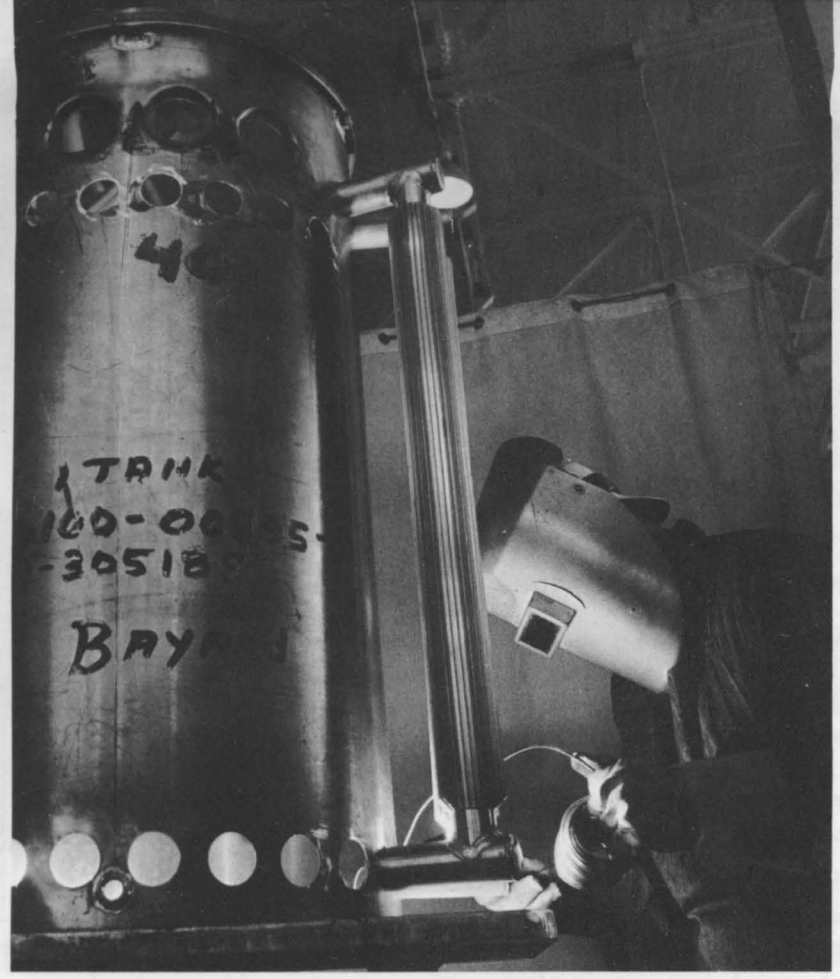
THERMITE *welding, left, employs chemical heat in a miniature "furnace," producing a veritable St. Elmo's fire. Essence of simplicity is cold pressure welding, above.*

RIVETING *a bridge girder. Cone-shaped rivets are being squeeze driven by hydraulic pressure.*

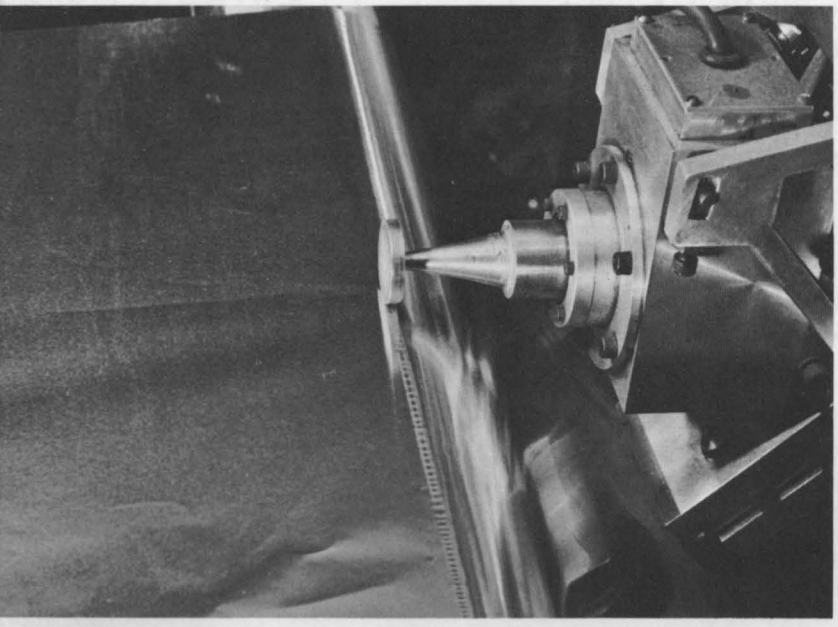


PYROTECHNIC DISPLAY *is flash welding. Detail view above shows arc made electrically between two ends of piece being joined. Actual joining takes place after two surfaces have been heated.*

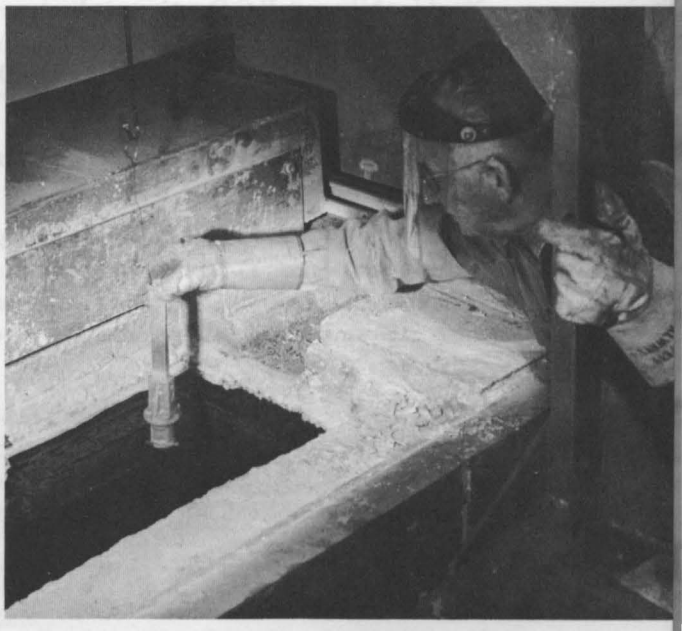




HOME FOR SPACE ANIMAL? *Not so. Rather, an electrical power distribution transformer case. Cooling fins are being attached by inert gas, tungsten arc welding process.*



HIGH-FREQENCY SOUND *is the newest, perhaps most exotic, joining medium. Vibrating at 50,000 cycles per second, ultrasonic welder shown is splicing coils of aluminum foil in rolling mill.*



DIP BRAZING *"action" is hidden from view in tank; operation is visually suited to be the "before" part of a liquid detergent TV commercial.*

ALLOYS for the DESIGNER

This reference was conceived to aid the designer in evaluating various aluminum alloys. Only those alloys of wide and general use—a small fraction of the total number—are included. The tables below are for the designer—not the engineer—since they represent a compromise aimed at brevity and value to the non-technical user. Virtually every statement is made in broad, comparative terms. The various comparative categories on the charts are·

Alloys. Numerical designations in common use. Wrought alloys use four-digit system; first digit designates alloy type or "family"; second designates modifications of original alloy developed, ("O" is the original); last two either indicate aluminum purity or an arbitrary designation (frequently these are numbers from an earlier two-digit system). Cast alloys are designated by two or, most commonly, three numbers; with some letter prefixes. The first digit indicates alloy type; other digits are arbitrary; prefixes indicate modifications of original development.

Strength. Comparative A-B-C-D ratings are in terms of relative decreasing strength. Each range is broad; a host of variables (such as temper and effects of various fabricating methods), are not reflected. Overall limits represented are from under 15,000 psi to over 90,000 psi, typical tensile strength.

Machinability. A-B-C-D ratings indicate relative ease by which a fabricated or semi-fabricated part may be cut by machining. Ratings indicate: A—excellent; B—good; C—fair; D—poor. (Ratings are for aluminum alloys as a group, and not in comparison with other metals.)

Cold Workability. A-B-C-D ratings for wrought alloys indicate their relative ability to be fabricated by various "cold" processes: A—excellent; B—good; C—fair; D—poor.

Resistance to Corrosion. A-B-C-D ratings indicate relative decreasing degrees of corrosion resistance; note that all aluminum alloys are among the most corrosion resistant of metals. Under varying circumstances, even alloys rated "A" may need protection in some exposures; while alloys rated "D" are frequently used unprotected with totally satisfactory results.

Weldability and Brazeability. Weldability and brazeability (wrought alloys) A-B-C-D ratings indicate: A—satisfactory using normal procedures; B—satisfactory using special procedures; C—limited suitability due to resultant loss of mechanical properties; D—no technique presently available that will perform suitably.

Castability. A-B-C-D ratings for casting alloys indicate decreasing relative ease of casting to shape by common foundry methods.

Pressure Tightness. A-B-C-D ratings for castings indicate relative decreasing freedom from interconnecting pores or other defects that would result in leakage when part is tested under pressure.

Fabricated Forms Available. Code indicates standard forms in which wrought alloys are available: S—sheet; P—plate; W—wire; R—rod; B—bar; Ro—rolled shapes; E—extruded shapes, tube and pipe; D—drawn tube and pipe; Ri—rivets; F—forgings.

Types of Castings. The following designations indicate major types of castings for which various alloys are suited: S—sand; Pl—plaster mold; PM—permanent mold; D—die castings.

43
195
214
A214
B214
F214
218
319
333
355
C355
356
A356
380
CASTING ALLOYS
WROUGHT ALLOYS
1100
2011
2014
2017
3003
5052
5056
5456
5457
6061
6063
6463
7075

D	A	B	A	A	S,PM,D	General-purpose alloy	Desirable where subsequent welding operations are planned
B	C	C	C	C	S	Housings, fittings, other parts requiring strength	Good machinability
A	C	A	D	B	S	Food, chemical, marine, architectural uses	Sand castings needing high corrosion resistance
A	C	A	D	B	PM,D	Cooking utensils, ornamental hardware	Good corrosion- and tarnish-resistance
B	C	A	C	B	S	Cooking utensils	Excellent resistance to corrosion; good anodized finish
A	C	A	D	B	S	Architectural parts, ornamental hardware	Use where sand castings are to be anodized
A	D	A	D	—	D	Marine fittings, hardware	For die castings of high strength, ductility, corrosion resistance
B	B	C	B	B	S	Typewriter frames, engine parts	Excellent casting characteristics; good mechanical properties
B	B	C	B	B	PM	Piano plates, fuel tanks	Excellent casting characteristics; good mechanical properties
B	A	B	A	B	S,PM,PI	Cases, housings, aircraft fittings	Good weldability and pressure tightness
B	A	B	A	B	PM,PI	Aircraft, missile components; rotating parts	Superior strength
B	A	B	A	B	S,PM,PI	Cases, housings, hardware, fittings	Good weldability and pressure tightness; high corrosion resistance
B	A	B	A	B	PM,PI	Aircraft, missiles, other high-strength structures	Where optimum cast strength is desired
C	B	C	B	—	D	General-purpose die castings	Excellent castability

STRENGTH	MACHINABILITY	CASTABILITY	RESISTANCE TO CORROSION	PRESSURE TIGHTNESS	GAS & ARC	TYPES OF CAST-INGS	TYPICAL APPLICATIONS	SPECIAL DESIGN NOTES

GENERAL CHARACTERISTICS
Approximate Ratings Compared with Other Aluminum Alloys

WELDABILITY

STRENGTH	MACHINABILITY	COLD WORKABILITY	BRAZEABILITY	RESISTANCE TO CORROSION	GAS	ARC	RESISTANCE, SPOT, OR SEAM	FABRICATED FORMS AVAILABLE	TYPICAL APPLICATIONS	SPECIAL DESIGN NOTES
D	A	A	A	A	A	A	B	S,P,W,R,B,Ri,F	Spun hollow ware, decorative parts	Cannot be heat treated
A	C	D	C	D	D	B		W,R,B	Screw machine products	High machinability; good mechanical properties
B	C	D	C	D	B	B		R,B,Ro,E,F	Heavy-duty structures	High strength and hardness at moderate cost
B	C	D	C	D	B	B		W,R,B,Ri	Screw machine products	Relatively high strength
D	A	A	A	A	A	B		All except Ro & Ri	General-purpose alloy	High formability, workability, weldability
D	A	C	A	A	A	B		S,P,W,R,B	Appliances, transportation uses	Good combination of strength, corrosion resistance, finish
D	A	D	A	C	A	B		W,Ri	Screen cloth, wire products, fencing	Good corrosion resistance, wire may be fine drawn
D	A	D	A	C	A	B		W,R,B	Welding rod	Use with 6061 tube for clean welded joints
D	A	C	A	A	A	B		S,P	Appliance, auto trim	Excellent finish characteristics
D	A	A	A	A	A	B		all	Furniture, fencing	Good strength and weldability
D	A	A	A	A	A	B		E,D	Windows, store fronts	High corrosion resistance, good appearance, low cost
D	A	A	A	A	A	B		E,F	Extruded auto trim	Excellent finish characteristics
B	D	D	C	D	B	B		S,P	Aircraft, keys	Very high strength and hardness

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***Note:**

All publications listed in starred (*) sections are available on request from:
Aluminum Company of America, 1501 Alcoa Building, Pittsburgh 19, Pa.

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